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ABSTRACT

This report includes: (1) a description of the way overweight and obesity have been measured by various investigators, including an assessment of the reliability and validity of the available measures; (2) data on the prevalence of overweight based on a literature review, including a list of issues that may influence estimates of prevalence (e.g., type of measure used, age of population); (3) a summary of the relationships among overweight, obesity, and health, including a review of the relationship between weight reduction and future health status; (4) a description of the Rand Health Insurance Study (HIS) measures of weight and overweight, including summary statistics for the measures based on data collected at the time of enrollment into the HIS of people aged 14 to 61; (5) tests of the reliability and validity of the HIS measures; (6) a brief description of the experimental hypotheses to be tested; and (7) a discussion of the measurement of eating habits. (Author)

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CONCEPTUALIZATION AND MEASUREMENT OF HEALTH HABITS FOR ADULTS IN THE HEALTH INSURANCE STUDY:

SP

VOL. II, OVERWEIGHT

PREPARED UNDER A GRANT FROM THE U.S. DEPARTMENT
OF HEALTH, EDUCATION, AND WELFARE

R-2374/2-HEW
JULY 1980

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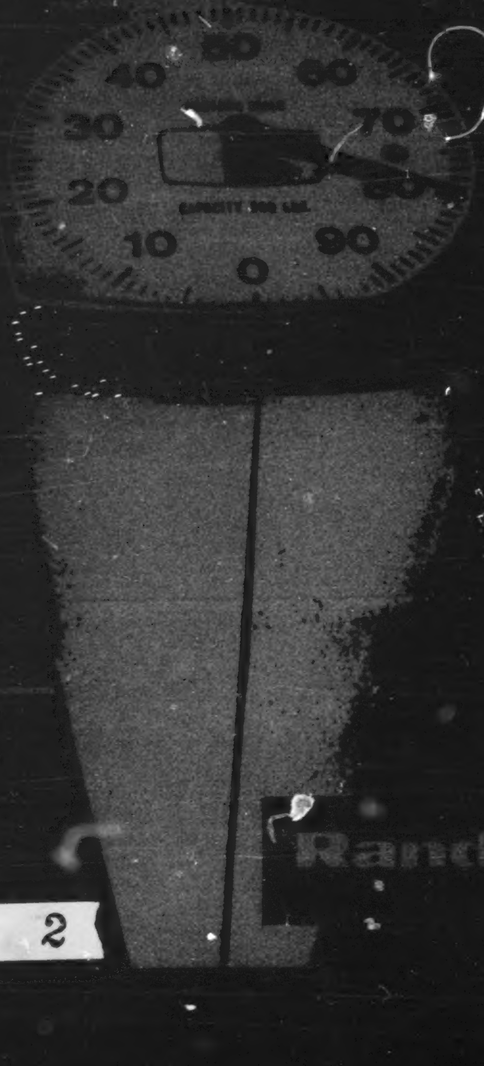

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PREFACE

The Rand Health Insurance Study, funded by a grant from the U.S. Department of Health, Education, and Welfare, is a large-scale social experiment designed to assess how varying the patient's cost of health services affects his or her use of services, quality of care, patient satisfaction, and health status. It is also designed to study how the provision of services in either the fee-for-service system or a prepaid group practice affects those same variables.

Nearly 8000 people in 2756 families were enrolled in the experiment in six sites across the United States: Dayton, Ohio; Seattle, Washington; Fitchburg, Massachusetts; Franklin County, Massachusetts; Charleston, South Carolina; and Georgetown County, South Carolina. The sites were chosen to represent the four Census regions of the country and an urban-rural mix, and to reflect variation in the amount of stress on the ambulatory medical care system (in terms of long or short delay for new and return appointments).

Families were enrolled in the Health Insurance Study for either three or five years (approximately 70 and 30 percent, respectively). Low-income families were oversampled. Eligibility for participation in the Health Insurance Study was broad; ineligible persons were mainly heads of household aged 61 and older at the time of enrollment, members of the military, people confined to various institutions, and people eligible for Medicare. When families were enrolled, they agreed to assign their own health insurance benefits (if they were previously covered) to the Health Insurance Study for the duration of their enrollment. Their policies were held in escrow and returned at the end of their participation in the Study. For persons who had not been previously insured, some coverage was obtained during the Health Insurance Study and made available at the end of enrollment.

The families were assigned to one of 16 different insurance plans. For this purpose, a complex, unbiased allocation model was used to ensure that the assortment of families in each plan closely resembled that in every other plan in terms of 24 different demographic and socioeconomic variables. The 16 experimental plans were as follows:

- One plan in which care is free to the family (i.e., 0 percent coinsurance).
- Three plans with 25 percent coinsurance (i.e., the family pays 25 percent of its medical bills).
- Three plans with 50 percent coinsurance.
- Three plans with 50 percent coinsurance for dental and outpatient mental health services and 25 percent coinsurance for all other services.
- Three plans with 95 percent coinsurance.
- One plan with 95 percent coinsurance on outpatient expenditures up to a maximum out-of-pocket expenditure of $150 per individual ($450 per family) per year and no coinsurance above that; all hospital care is free on this plan.
- One plan that assigns some Seattle participants to a prepaid group practice (Group Health Cooperative of Puget Sound).

- One plan (a control group) that consists of a random sample of people already enrolled in the Seattle prepaid group practice who also meet the Health Insurance Study eligibility requirements.

All plans except the first one and the last three have a ceiling on annual out-of-pocket expenditures paid by the family amounting to 5, 10, or 15 percent of annual family income. The maximum out-of-pocket expenditure per year per family is $1000 for the 50 and 95 percent coinsurance plans and $750 for the 25 percent plans. All plans have an identical, very comprehensive benefits package that covers ambulatory and hospital care, preventive services, all dental services except orthodontia, prescription drugs, certain over-the-counter drugs, most supplies and durable medical equipment, psychiatric and psychological services, and almost all other personal medical services, including those delivered by chiropractors and Christian Science healers.

Over the life of the Health Insurance Study, data are collected on demographic and socioeconomic variables, health status, use of health services, satisfaction with and attitudes toward health care, and types of providers seen for care. The sources of health data include baseline interviews before enrollment, self-administered (or parent-completed) Medical History Questionnaires, biweekly Health Reports, annual Health Questionnaires, medical screening examinations, and claims submitted (chiefly by providers) for reimbursement for services rendered.

Comprehensive assessment of each person's health status occurs upon enrolling in the experiment, annually during the enrollment period, and upon leaving. As noted, a major Health Insurance Study objective is to assess the effects of varying the cost of health services on the health status of individuals sampled from a general population. To this end, reliable, valid, and understandable measures are being specially developed or adapted that will detect small but meaningful changes in the health status of enrollees.

Enrollment in the Health Insurance Study began in 1974. At the time of writing this Rand report series (R-2374-HEW), the Health Insurance Study is still in progress. Enrollment data from all six sites are available and reported herein, but longitudinal (experimental) data are not yet available.

This series presents information on two health habits, smoking and overweight, that are being used in the Health Insurance Study as proxy measures of future health status. These health habits could conceivably be influenced by personal medical care, and the evidence strongly suggests that they have a serious effect on future morbidity and premature death.

The two volumes in this series, which has the overall title *Conceptualization and Measurement of Health Habits for Adults in the Health Insurance Study*, are both by Anita L. Stewart, Robert H. Brook, and Robert L. Kane: Vol. I, *Smoking*, R-2374/1-HEW, June 1979; and the present Vol. II, *Overweight*, R-2374/2-HEW, July 1980.

Each volume contains information based on a review of the literature regarding the conceptualization and measurement of the health habit, and the relationships between the health habit and future health status. Also included is a description of the measures used in the Health Insurance Study to assess the health habit, analyses of health habit data collected at enrollment into the Study, and a list of the experimental hypotheses to be tested using the health habit measures.

Three other dimensions of health status—physical, mental, and social health—

have been defined for the Health Insurance Study, as has an integrative measure—general health perceptions. These measures are described in the eight volumes of R-1987-HEW, which has the series title *Conceptualization and Measurement of Health for Adults in the Health Insurance Study.*

In the R-1987-HEW series, detailed descriptive information about the Health Insurance Study, including site and sample selection methods, can be found in Vol. I, *Model of Health and Methodology* (May 1980), by John E. Ware, Jr., Robert H. Brook, Allyson Davies-Avery, Kathleen N. Williams, Anita L. Stewart, William H. Rogers, Cathy A. Donald, and Shawn A. Johnston. A synopsis of the health measurement strategy and enrollment results for these three health dimensions from the first site (Dayton, Ohio) appears in Vol. VIII, *Overview* (October 1979), by Robert H. Brook, John E. Ware, Jr., Allyson Davies-Avery, Anita L. Stewart, Cathy A. Donald, William H. Rogers, Kathleen N. Williams, and Shawn A. Johnston; this is also published as a supplement to *Medical Care*, July 1979. Other volumes give more detailed methods and enrollment results for physical health in terms of functioning (Vol. II, July 1978), mental health (Vol. III, December 1979), social health (Vol. IV, August 1978), and general health perceptions (Vol. V, September 1978). More specialized analyses are covered in Vols. VI (forthcoming) and VII (March 1979) on relations among health status measures and power analysis of the measures, respectively.

Measurement of these same health status dimensions for children under age 14 enrolled in the experiment is discussed by Marvin Eisen, Cathy A. Donald, John E. Ware, Jr., and Robert H. Brook in *Conceptualization and Measurement of Health for Children in the Health Insurance Study*, R-2313-HEW, May 1980.

Measurement of physiologic health is discussed in the forthcoming series by Robert H. Brook, George A. Goldberg, L. Jeff Harris, Kenneth H. Applegate, Marc Rosenthal, and Kathleen N. Lohr in *Conceptualization and Measurement of Physiologic Health for Adults*, R-2262-HHS.

A number of other Rand reports and publications discuss design and measurement issues related to the experiment. The most recent listing of Health Insurance Study publications is given by Joseph P. Newhouse and Rae W. Archibald, *Overview of Health Insurance Study Publications*, P-6221, November 1978. The experimental design for estimating the effects of financing on demand for care is described in three publications by Joseph P. Newhouse: "A Design for a Health Insurance Experiment," *Inquiry*, Vol. 11, 1974, pp. 5-27; *The Health Insurance Study—A Summary*, R-965-1-OEO, March 1974; and *A Summary of the Rand Health Insurance Study*, CP6, revised August 1980. The structure of the experiment is reported in Lorraine Clasquin and Marie E. Brown, *Rules of Operation for the Rand Health Insurance Study*, R-1602-HEW, May 1977. Carl Morris describes the unbiased allocation model for assigning families to insurance plans in "A Finite Selection Model for Experimental Design of the Health Insurance Study," *Journal of Econometrics*, Vol. 11, 1979, pp. 43-61. *The Health Insurance Study Screening Examination Procedures Manual*, R-2101-HEW, September 1978, by Lisa H. Smith, George A. Goldberg, Robert H. Brook, Laura Tosi, and Rae W. Archibald, presents a detailed description of all aspects of tests and procedures carried out in the enrollment and exit screening examinations.

SUMMARY

Being overweight and eating habits are measured in the Rand Health Insurance Study (HIS) as part of the assessment of health habits. Although overweight as such is not a health habit, it is indicative of a variety of habits. One could think of it as "behaving so as to maintain a normal weight." This report primarily describes the measurement of weight and overweight in people aged 14 to 61; eating habits are discussed in an appendix. Weight and overweight are being measured in the HIS because more or better personal medical care services (which may be a consequence of more generous health insurance) may effect a reduction in weight in those people who are overweight. By generous health insurance, we essentially mean free care. It has been suggested by others that a reduction in the number of people in the American population who are severely overweight could lead to a reduction in both future morbidity and premature death.

This report includes (1) a description of the way overweight (and obesity) have been measured by various investigators, including an assessment of the reliability and validity of the available measures; (2) data on the prevalence of overweight based on a literature review, including a list of issues that may influence estimates of prevalence (e.g., type of measure used, age of population); (3) a summary (based on a review of the literature) of the relationship between overweight (and obesity) and health, including a review of the relationship between weight reduction and future health status; (4) a description of the ~~HIS~~ measures of weight and overweight, including summary statistics for the measures based on data collected at the time of enrollment into the HIS of people aged 14 to 61; (5) tests of the reliability and validity of the HIS measures; (6) a brief description of the experimental hypotheses to be tested; and (7) a discussion of the measurement of eating habits.

MEASUREMENT OF OVERWEIGHT AND OBESITY AS REPORTED IN THE LITERATURE

Overweight and obesity are not necessarily the same. Obesity refers to excessive body fat, whereas overweight implies a weight heavier than some standard (e.g., heavier than average).

In this report, we will use the following terminology:

Body fatness—how much fat a person has
Weight-for-height—weight in relation to height
Obesity—excess body fatness, estimated according to some criterion
Overweight—excess weight-for-height estimated according to some criterion

The types of measures of fatness and weight that we discuss are

Body fatness
  Body density
  Skinfold thickness

- Weight-for-height
  - Relative weight
    - Relative average weight (mean weight for a specified group)
    - Relative recommended weight
      - Life insurance recommended
      - National Center for Health Statistics (NCHS) recommended
  - Power-type indices
    - W/H W/H^2 $\sqrt[3]{W}/H$
    - $W/H^{1.5}$ W/H^3 $H/\sqrt[3]{W}$

Body fatness is most commonly assessed using measures of either body density or skinfold thickness. Of these, measures of skinfold thickness are more practical to perform; however, they require a skinfold caliper and a person trained in its use.

Indices of weight in relation to height have the advantage of being easily and accurately measured. Two general categories of these indices are relative weight and power-type indices.

Relative weight indices are those in which a person's weight is defined in relation to a reference weight, which can either be an average or a recommended weight. Recommended weights are most frequently derived from actuarial data collected by life insurance companies and are defined as the weight at which a person has the best chance of survival. Recommended weight has also been defined by the National Center for Health Statistics (NCHS) as the average weight of people aged 20 to 29. Average weights are commonly obtained from data published by life insurance companies and less commonly based on data published by NCHS.

Power-type indices are those using a ratio of weight to some power function (p) of height (e.g., W/H^2). The power function is intended to minimize the effect of height in the measure. The six most commonly used power-type indices are (1) W/H; (2) $W/H^{1.5}$; (3) W/H^2, sometimes referred to as Quetelet's Index or Body Mass Index; (4) $\sqrt[3]{W}/H$, often called the ponderal index; (5) $H/\sqrt[3]{W}$, the reciprocal of the ponderal index, and (6) W/H^3.

In order to be useful, the reliability and validity of these measures must be acceptable. Based on a literature review, we determined that the reliability of body fatness measures was high in the few studies in which it was tested. Almost no studies were reported of the reliability of measures of weight and height (although studies are presented in this report based on HIS data).

We used several approaches to study the validity of measures of weight and fatness that were described in the literature. Our conclusions regarding the validity of measures described in the literature are (1) people tend to slightly underreport when asked to self-report their weight; (2) measures of skinfold thickness are valid indicators of body fatness; (3) power-type indices are preferred to relative weight indices, primarily because they do not require use of a reference weight (such as recommended or average weight); (4) the best power-type index is one determined to be independent of height for the population of interest; based on the literature, the best power-type index for men appears to be W/H^2 and for women either W/H or $W/H^{1.5}$; (5) the poorest power-type indices are the various ponderal indices (W/H^3, $\sqrt[3]{W}/H$, and $H/\sqrt[3]{W}$).

Criteria used to define overweight or obesity are somewhat arbitrary. Because of this, many investigators define these concepts as continuous variables or group the weight data into quintiles or deciles when determining relationships between weight and other variables of interest.

PREVALENCE OF OVERWEIGHT AND OBESITY

Prevalence estimates of overweight and obesity vary depending on the following characteristics:

1. Age of population.
2. Sex of population.
3. Socioeconomic status of population.
4. Type of measure used to assess weight or fatness.
5. Criteria used to define overweight or obesity.

Weight tends to increase with age to about middle age and then declines slightly in the older age groups. As a result, for middle-aged and older people, estimates of the prevalence of overweight will be lower when using measures of relative average weight than when using age-independent measures such as relative recommended weight. Women tend to have more fat than men at a given age. Women born earlier in the century tend to be heavier at a given age than women born later. Men born earlier in the century tend to be lighter at a given age than men born later. There is a trend for women in lower social classes to be more overweight. For men, the trend is similar but less consistent.

Most available prevalence estimates of overweight use a measure of relative recommended weight (life insurance recommended) and a criterion of ≥ 120 or ≥ 125 percent of recommended weight as a measure of overweight. Using this criterion, from one-seventh to one-half of the populations studied were overweight.

RELATIONSHIP BETWEEN OVERWEIGHT AND FUTURE HEALTH STATUS

We examined the relationship between overweight (and obesity) and the following major health status outcomes: overall premature mortality, the prevalence of and mortality due to heart disease (coronary heart disease, sudden death, myocardial infarction, angina pectoris, and coronary artery disease); the prevalence of and mortality due to diabetes; and hypertension and high blood cholesterol. The relationship between weight reduction and health has rarely been studied; we found a few studies on the relationship between weight reduction and overall premature mortality and blood pressure.

Although the evidence suggests that there is a relationship between overweight (and obesity) and health, it is equivocal. The relationship depends on the population studied, the measure used, the follow-up period, the outcome that is evaluated, and the method of analysis. For some specific outcomes, the relationship is clear. Overweight is positively and linearly related to hypertension, sudden death, and angina pectoris. For some manifestations of heart disease (e.g., myocardial infarction), a relationship is sometimes found and sometimes not. For the outcome of overall premature mortality, a U-shaped relationship is most commonly found in which the lowest mortality is experienced by normal weight people. Extremely overweight people consistently experience higher premature mortality than normal weight people; underweight people sometimes experience higher premature mortality than do normal weight people. For diabetes, a dramatic increase in mortality and morbidity is observed as weight increases beyond a certain point.

MEASUREMENT OF WEIGHT AND OVERWEIGHT AT TIME OF ENROLLMENT INTO THE HEALTH INSURANCE STUDY

For all people aged 14 to 61 who were enrolled into the HIS, body weight and height were measured by self-report on a self-administered Medical History Questionnaire (MHQ). A battery of items assessing overweight and its effects was also included in this questionnaire. For a randomly selected sample of the enrollees who took the medical screening examination (MSE), technicians measured the person's height and weight.

A large number of measures of weight and overweight were constructed using HIS enrollment data. Some of these will be used as primary outcome measures to test experimental hypotheses. Some will be used as mediating variables in analyses of models of health and health habits. Some will not be used in the HIS, but we present them here to provide information to other investigators who might prefer measures other than those that we selected.

For each measure based on weight and height (e.g., W/H^2), we constructed two scores; one was based on MHQ data and the other on MSE data. A summary of the measures is as follows:

Weight
Weight in pounds (MHQ and MSE)
Weight in kilograms (MHQ and MSE)
Maximum ever weighed (MHQ)

Height
Height in inches (MHQ and MSE)
Height in meters (MHQ and MSE)

Weight Adjusted for Height
W/H
$W/H^{1.5}$
W/H^2
Standardized W/H^p (for men W/H^2 and for women $W/H^{1.5}$) (MHQ and MSE)

Relative Recommended Weight (RRW)
RRWL: Life insurance recommended (MHQ and MSE)
RRWN: National Center for Health Statistics recommended (MHQ and MSE)

Overweight
Overweight: Self-evaluation (MHQ)
Overweight: Criterion-based (MHQ and MSE)

Weight Loss
Difference between maximum and current weight (MHQ)

Effects of Being Overweight
Number of approaches taken to lose weight (MHQ)
Under a doctor's care to lose weight (MHQ)
Worry/concern over weight (MHQ)
Pain caused by weight (MHQ)

Restricted activity caused by weight (MHQ)
Overweight Impact Index (MHQ)

Based on our analyses to develop these measures, the best measure of weight adjusted for height was W/H^2 for men and $W/H^{1.5}$ for women. We therefore constructed a standardized W/H^p (i.e., a z score) using these values so that a single measure of weight adjusted for height could be used. We recommend that this standardized W/H^p be used in other studies as well, as it appears to be the best continuous measure of weight.

The standardized W/H^p and the criterion-based measure of overweight will be used as the primary dependent variables in testing experimental hypotheses in the HIS of the effect of insurance plan on weight. The other measures were constructed primarily for purposes of comparison with other studies and for use in validity studies of HIS measures.

The percentage of people who are either moderately or severely overweight based on the HIS criterion-based measure averages 22 percent using MHQ data and 30 percent using MSE data. The percentage of people who are severely overweight averages 12 percent using MHQ data and 17 percent using MSE data. More women than men are severely overweight.

RELIABILITY AND VALIDITY OF THE HEALTH INSURANCE STUDY MEASURES OF WEIGHT, HEIGHT, AND OVERWEIGHT

Our study of the reliability and validity of the HIS measures of weight, height, and overweight can be summarized by the following observations: First, the test-retest reliability coefficients of the measures of weight and height obtained at the MSE were very high.

Second, a digit preference occurred in the reporting of weight: Weights ending in zero or five were reported more often than would be expected by chance. No such tendency occurred for height.

Third, we compared the self-reported weight and height with the actual measures of weight and height obtained at the MSE. Both the reliability and the validity of the self-reported measures were very high. There was a tendency for people to slightly underreport their weight by about two pounds and overreport their height by 0.6 inches. There were differences in reliability and validity between some groups of people. For example, women underreported their weight to a greater extent than men, and women with the least education were less reliable in reporting weight than women with the most education.

Fourth, a comparison of HIS data on weight, height, and overweight with data collected on a national probability sample revealed comparable weights and heights.

Fifth, we found that the types of approaches taken to reduce differed for people under a doctor's care to lose weight: Those under a doctor's care were most likely to be on a diet (91 percent) or to be taking reducing pills (41 percent), whereas those not under a doctor's care were most likely to be on a diet (27 percent) or to be exercising (26 percent).

Sixth, we evaluated the likelihood of being under a doctor's care to lose weight as a function of the severity of overweight (defined using the criterion-based measure) for those people who believed they were overweight. People who were severely overweight were more likely to be under a doctor's care to lose weight than moderately overweight people (7 percent of moderately overweight people and 11 percent of severely overweight people).

Seventh, we evaluated the effect of being overweight (in terms of pain, worry, and restricted activities) as a function of the severity of overweight (defined using the criterion-based measure). Pain, worry, and restricted activity are all increased as overweight is more severe. The extent of worry is the greatest. Of those who are severely overweight, 79 percent worry about their weight, 32 percent experience pain due to their weight, and 29 percent experience restricted activities due to their weight.

Eighth, comparison of the prevalence of overweight based on subjective evaluation (whether people believe they are overweight) with prevalence based on the criterion-based measure revealed that more people subjectively evaluate themselves as overweight than were defined as overweight by the criterion-based measure. Of those people who believe they are overweight, only 44 percent were classified as overweight using the criterion-based measure. Of those people who were classified as overweight using the criterion-based measure, 82 percent believe they are overweight. Thus, peoples' own standards are more strict than the criterion of overweight used in this study.

Finally, associations among all of the continuous measures of weight (W/H, $W/H^{1.5}$, W/H^2, standardized W/H^p, RRWN, and RRWL) were very high (product-moment correlations were all above 0.90).

HYPOTHESES TO BE TESTED

Our basic hypothesis is that the generosity of insurance will have a beneficial effect on weight. We consider two beneficial effects to be (1) severely overweight people reduce, and normal weight and moderately overweight people do not become severely overweight (i.e., there will be a lower proportion of people in the severely overweight category in the generous plans); and (2) moderately and severely overweight people lose weight (i.e., moderately and severely overweight people will have a lower mean weight in the generous health plans than those enrolled in less generous plans). Because the literature indicates that being severely overweight is associated with at least some types of poorer health status in the future (e.g., overall mortality, increased prevalence of diabetes and heart disease), we will consider the first beneficial effect as a proxy measure of future health status. The second beneficial effect is less clearly a proxy measure of future health status (i.e., the health risks of being only moderately overweight are minimal if they exist at all). However, there are reasons other than pure health effects, such as good appearance, that motivate a person to lose weight. Although in this report we did not evaluate the effect of being overweight on social and psychological outcomes, a person's sense of well-being and self-esteem may be improved by losing weight. This may be especially true for younger people (age 45 and under), for whom society places a high value on being thin. To the extent that self-esteem and a sense of well-being contribute to peoples' overall health, such weight loss may be beneficial to their health.

One of the problems with using weight loss in overweight people as a proxy measure of health status is that weight loss may be a symptom of disease and thus will be a proxy for poorer health. We will therefore eliminate from the hypothesis testing outlined above those people with diseases that might be associated with weight loss, such as cancer, end-stage kidney disease, severe liver disease, malabsorption syndrome (including inflammatory bowel disease), end-stage chronic obstructive pulmonary disease, severe thyroid problems, and other chronic diseases, as well as those people who have had recent major surgery. We will not exclude people with diabetes or with hypertension (unless they also have one of the above conditions).

If no effect of insurance plan is observed, we will perform additional analyses using various subgroups of the population in which effects might be more likely to occur. For example, we will look at a subgroup of people with hypertension, testing the hypothesis that people with hypertension will be more likely to have beneficial weight changes with generous insurance than without generous insurance. Other subgroups of interest are people with coronary heart disease and diabetes.

MEASUREMENT OF EATING HABITS

Eating habits of interest in the HIS are whether people eat breakfast and whether they refrain from eating between meals. These are not intended to be exhaustive measures of eating habits. Rather, they were selected because other studies had determined that these two eating habits were associated with increased longevity. In the few studies that evaluated the effects of eating habits on health status, the trend was that poorer health was associated with both not eating breakfast or eating between meals almost every day.

We constructed three measures of eating habits for use in the HIS:

1. Frequency of eating breakfast
2. Frequency of eating between meals
3. Number of positive eating habits

About half of the HIS sample eats breakfast every day, about one-fourth eat between meals rarely, occasionally, or never, and about 15 percent practice both positive eating habits. Thus, if generous health insurance has an effect on eating habits, there is considerable room for improvement. We observed no association, however, between these measures of eating habits and either of the measures of overweight.

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I. INTRODUCTION

Being overweight and eating habits are two of several health habits being assessed in the Rand Health Insurance Study (HIS). Although overweight as such is not a health habit, it is indicative of a variety of habits; one could think of it as the health habit "behaving so as to maintain a normal weight."

The HIS is a social experiment in which people in six U.S. sites were assigned randomly to one of 16 health insurance plans (see Newhouse, 1974, and the preface of this volume). This report primarily describes the conceptualization and measurement of overweight in people aged 14 to 61 who are enrolled in the HIS.[1] The measurement of eating habits is discussed in Appendix A. The HIS is in progress at the time of writing this report; thus, all data reported here are those obtained at the time the sample was enrolled in the HIS.

ORGANIZATION OF THE REPORT

This report first describes types of measures commonly used to assess overweight and obesity, assesses their reliability and validity, and presents the criteria used for each of the measures to distinguish people who are overweight or obese from those who are not.

Second, based on a literature review, we describe the prevalence of overweight and obesity, discussing the methods issues that may influence estimates of prevalence.

Third, we examine the relationship between overweight and obesity and selected major health outcomes, and the relationship between weight reduction and subsequent health status.

Fourth, we describe how weight and overweight are measured in the HIS in terms of the items included in the HIS and the measures constructed from those items. We present descriptive statistics for the measures. These statistics are based on data obtained at enrollment of people into the HIS.

Fifth, we evaluate the reliability and validity of the HIS measures of overweight.

Sixth, we present a brief description of the experimental hypotheses to be tested.

Finally, we describe the measurement of eating habits (eating breakfast and eating between meals) in Appendix A.

HEALTH HABITS

Health habits can be either positive (have a beneficial effect on health) or negative (have an adverse effect on health). In a generic sense, health habits refer

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[1] The measurement of overweight in children will be described separately in a report by Foxman, Brook, Goldberg, et al. (forthcoming).

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to all behaviors performed by a person that affect health status. However, to be included in the HIS, a health habit had to be both changeable by an action taken in the personal medical system (e.g., doctor places patient on diet) and related in some way to either future morbidity or premature mortality. The health habits measured in the HIS include smoking, overweight, alcohol consumption, exercise, the use of seat belts, hours of sleep, use of over-the-counter drugs, dental habits such as the use of floss, sugar consumption, obtaining preventive care such as immunizations, and performing self-help procedures such as breast self-examination.

PURPOSE OF MEASURING HEALTH HABITS IN THE HEALTH INSURANCE STUDY

The primary reason for developing health habit measures in the HIS is to provide data for analyses of the effects of changes in the quantity and/or quality of personal medical care services, used as a function of insurance plan generosity (free versus some coinsurance), on the performance of health habits.

The HIS measures of health habits will be used also as proxy measures of future health status in tests relating generosity of health insurance to future health status. Because some of the HIS health habits were selected to be predictive of future morbidity and premature mortality, some health habits scores at the end of the HIS will be used to predict the future health status of groups of people who were enrolled in the HIS.

This use of the measures of health habits "artificially" extends the length of the HIS, and will permit us to determine what effect, if any, the generosity of the insurance will have on those aspects of future health status affected by changes in current health habits. Although actual health status is measured throughout the course of the HIS, the sample size of the HIS and its five-year time span will not be sufficient to observe an effect of the generosity of the insurance on all aspects of health status such as age-specific death rates. The time span probably is sufficient, however, to observe an effect of the insurance level on health habits, if such an effect is produced by changing the generosity of a person's insurance plan. The use of health habits as proxy measures of health status assumes that the total effect of the insurance plan (or most of the effect) on health habits will be achieved within the time span of the HIS and that this difference among the groups of adults who are enrolled in different insurance plans would have been maintained if the HIS had continued indefinitely. Both of these assumptions will be tested by comparing changes that occurred in those people enrolled for three years with those enrolled for five years.

We will also use the HIS measures of health habits to attempt to explain why certain people develop or adopt positive health habits. One model that will be tested is the Health Belief Model (Becker and Rosenstock, 1974), which identifies a series of factors (e.g., belief in the efficacy of medical care, perceived risk of developing a disease if a particular health habit is not adopted, cues to action from a physician) that may be important in explaining changes in health habits. The HIS is particularly suited to this task because data on many attitudinal variables such as those described above are collected at multiple points in time. Because of this longitudinal nature of the HIS data collection activities, analyses can be performed to test temporal sequences (e.g., testing if a belief preceded a change in behavior, or followed the adoption of a behavior). The Health Belief Model tested in the HIS will be a general one, as opposed to one specific to health habits. That is, most of the HIS measures of components of the Health Belief Model are not specific to health habits. For example, in the HIS we do not measure the perceived risk of developing a disease caused by overweight but instead measure perceived susceptibility to illness in general.

Finally, we will use the HIS measures of health habits to evaluate the effects of combinations of health habits on future health status. All of the measures of health habits obtained at enrollment into the HIS will be used to predict health status at the end of the HIS, either three or five years later.

MEASUREMENT CRITERIA

To ensure that HIS measures of health habits would fulfill their intended purpose, that is, provide data to allow analyses of the effects of different health insurance plans on individual health habits, the measures had to meet the following criteria:

1. The measures should be applicable to a general population.
2. The measures should reflect health habits that are sensitive to the effects of medical care, that is, health habits that could conceivably be changed as a result of the use of more or better medical services.
3. The measures should reflect health habits that are known to be predictive of either future morbidity or premature mortality; this is essential for the health habits measures to be useful in the HIS as proxy measures of future health status.
4. The measures should be sensitive to differences in health habits that are known to affect health status; for example, if in the literature very slight differences in weight were found to have noticeable effects on health status, the HIS measures should be constructed to be sensitive to such differences. Conversely, if the only effect on health status was whether a person was grossly overweight or not, the HIS measures would not need to detect the various levels of the amount of overweight present.
5. The measures should be as free from error as possible (i.e., be reliable) to allow us to estimate with confidence the average levels of health habits within groups and to compare different groups in the enrolled population (e.g., between insurance plans).
6. Score distributions for each measure should have sufficient variability to be useful in detecting actual differences in health habits of people in a general population for whom repeated measures are available (i.e., should have sufficient power for purposes of testing the hypotheses listed above).
7. The operational definitions of each health habit should be comprehensive with respect to the way each has been defined in the literature.
8. The items used to measure each health habit should be combined in such a way that the number of variables (or scores) used to define that health habit is reduced as much as possible without substantial loss of information.

The HIS was not limited to construction of a single health habit measure, that is, one that would yield a single score representing an individual's overall status with respect to that health habit. For each health habit included in the HIS, many items were used, and several scores were constructed based on those items.

Cost constraints on data collection indicated that self-administered questionnaires were preferred for the collection of most data, although in regard to overweight actual measurement of weight and height was completed on a random sample of enrollees at the time of enrollment into the HIS and will be measured on all enrollees at the time of exit from the HIS. The questionnaire strategy was adopted when it appeared that reliance on self-administered questionnaires, with appropriate assistance and follow-up when needed, would yield data of high quality, even among the least educated groups enrolled in the HIS.

Finally, the HIS required, to the extent possible, that the measures be selected from those previously fielded in studies of general populations (or be adapted from such measures), so that HIS results would be comparable to those obtained from national probability sample surveys, such as the National Health Interview Survey (USDHEW, 1975c).

II. MEASUREMENT OF OVERWEIGHT AND OBESITY AS REPORTED IN THE LITERATURE

In this section we summarize the literature on (1) the types of measures commonly used to assess overweight and obesity, (2) the reliability of these measures, (3) the validity of the measures, and (4) criteria for identifying people who are overweight or obese.

TYPES OF MEASURES

Overweight and obesity are not necessarily synonymous. Obesity refers to the accumulation of excessive body fat or adiposity, whereas overweight simply implies heavier than some standard (e.g., heavier than average).

Conclusions about the relationship of overweight or obesity to health may differ depending on which one is measured. Because terminology is not agreed on, conclusions from the literature may be confusing. Many investigators use measures of weight, yet refer to them as measures of obesity. For purposes of this report, we will use the following terminology:

Body fatness—how much fat a person has,
Weight-for-height—weight in relation to height,
Obesity—excess body fatness, measured according to some criterion,
Overweight—excess weight for height, measured according to some criterion.

Body Fatness

Two methods are commonly used to assess body fatness: body density and skinfold thickness.[1] Of these, body density is the more direct measure of fatness.

Body Density. One method for determining body fatness estimates the percentage of the body represented by fat by assessing the density of the body.[2] This method takes into account both deep fat deposits and subcutaneous fat.

Body density is calculated by dividing the total body weight in air by the total body volume, where body volume is essentially weight in air minus weight in water[3] (Keys and Brožek, 1953). Because body fat is less dense than other body materials, fatness is indicated by a lower body density. Some investigators convert body density to a measure of adiposity (i.e., fat content). A table for converting specific gravity to fat content is available (see Rathbun and Pace, 1945, or Chen, 1953).

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[1] For a detailed discussion and literature review of the measurement of body fatness, see Keys and Brožek (1953) and Bray (1976).

[2] The terms *specific gravity* and *density* are used synonymously by many investigators. Although under certain conditions that definition is true, it is not always the case. The density of a substance (D) is defined as the mass (M) of the substance per unit volume (V) (i.e., $D = M/V$). The specific gravity of a substance is the ratio of its density to the density of water and must be reported for a specified water temperature and substance temperature. Because of this, it is preferable to use body density rather than specific gravity (Keys and Brožek, 1953).

[3] More precisely, the volume is the weight in air minus the weight in water, where the underwater weight is corrected for air in the lungs and respiratory passages (Brožek and Keys, 1951; Keys and Brožek, 1953; Keys and Grande, 1973; Allen, Peng, Chen, et al., 1956). See Pascale, Grossman, Sloane, et al. (1956) for a detailed description of this method. See any of these articles by Keys for a detailed description of body composition.

Skinfold Thickness. Because a large proportion of fatty tissue is located just under the skin, one indirect way to measure body fatness is to measure the thickness of this subcutaneous layer. This is done by pinching up a fold of skin from a selected place (e.g., the back of the arm) and measuring its thickness with a skinfold caliper.[4] The two skinfold measures generally used are the triceps skinfold (midway at the back of the upper right arm flexed 90 degrees) and the subscapular skinfold (just below the angle of the right scapula). These are sometimes combined into a single measure by adding the results of the two skinfold measures.

The major advantage of measures of skinfold thickness over body density measures is that they provide a more practical way to measure body fat. However, they do require a person trained to use a skinfold caliper.

Weight-for-Height Indices

Indices of weight in relation to height are based on the person's weight and height; these data can be obtained either by self-report or by direct measurement.

Two general categories of weight-for height indices are relative weight indices and power-type indices. Relative weight indices are a ratio of a person's weight to some reference weight such as average weight. Power-type indices are a ratio of weight to some power of height (e.g., W/H^a).

Relative Weight Indices. Indices in which a person's weight is defined in relation to a reference weight are known as relative weight indices. The reference weight can either be an average or a recommended (sometimes called "desirable" or "ideal") weight. Recommended weights are most frequently derived from life insurance data, where they are defined as the weight at which a person has the best chance of survival (Metropolitan Life Insurance Company, 1960). Recommended weights have also been defined by the National Center for Health Statistics (NCHS) as the mean weight of people aged 20 to 29, adjusted for height (USDHEW, 1979b); this definition is based on the assumption (i.e., not based on empirical evidence) that any weight gain after this age is due to fat accumulation and is undesirable. Average weights for people of the same sex, height, and age can be based on national norms (e.g., data collected in the national Health and Nutrition Examination Survey (USDHEW, 1979a)) or they can be based on the average weight of the population being studied (e.g., Kannel, Brand, Skinner, et al., 1967).

An example of a relative weight index is

$$\frac{\text{Weight}}{\text{Average weight for people of the same age, sex, and height}} \times 100\,.$$

Relative weight is thus expressed as a percent of the reference weight. For example, a value of 100 indicates average or recommended weight, and a value of 120 indicates a weight that is 20 percent greater than the average or recommended weight.

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[4] See Seltzer and Mayer (1965) for a detailed discussion of the technique for measuring skinfold thickness.

In this report, the term *relative average weight* (RAW) will refer to relative weight using average weight as the reference. Similarly, *relative recommended weight* (RRW) will refer to relative weight when recommended weight is the reference. We will further distinguish relative recommended weight measures as to the definition of recommended weight used. When we use life insurance company recommended weights, the measure will be referred to as *relative recommended weight—life insurance recommended* (RRWL). When we use the mean weight of people aged 20 to 29 years (based on national data), the measure will be referred to as *relative recommended weight—NCHS recommended* (RRWN). Analysis of the above weight standards indicates that some (e.g., relative average weight) rise with age while others (e.g., relative recommended weight—NCHS) do not.

Power-Type Indices. Power-type indices are those using a ratio of weight to some power function (p) of height (e.g., W/H^p). The power function is intended to minimize the effect of height in the measure. Florey (1970) suggests the term *index of corrected weight* for these indices; that is, they represent attempts to summarize a person's weight correcting for height.

The six most commonly used power-type indices are W/H: $W/H^{1.5}$; W/H^2 (sometimes referred to as Quetelet's index or Body Mass Index); $\sqrt[3]{W}/H$ (often called the ponderal index); $H/\sqrt[3]{W}$, the reciprocal of the ponderal index; and W/H^3.

The last three indices (all variations of the ponderal index) are the source of much confusion in the literature. The original ponderal index $\sqrt[3]{W}/H$ was introduced by Livi (1897). In 1940, Sheldon, Stevens, and Tucker (p. 265) inverted it to $H/\sqrt[3]{W}$ and called it a variation of the ponderal index. The variation was widely used, even though the alteration makes the index smaller as weight increases (Mann, 1974). In addition, some investigators have substituted W/H^3 for $H/\sqrt[3]{W}$ to change the correlation with weight to a positive one (Khosla and Lowe, 1967).

RELIABILITY OF MEASURES

Body Fatness

Body Density. The reliability of body density measures has been studied by obtaining repeated measures on a group of subjects. In one study, 25 men living under controlled conditions at caloric balance (so an actual change in fatness was unlikely) were reexamined after a one-week interval. The correlation between the two measures was 0.95 (Keys and Brožek, 1953, p. 274).

Skinfold Thickness. Skinfold thickness is measured using a caliper. The skinfold is placed between the caliper branches and the thickness measured. Errors in the measurement of skinfold thickness can arise from (1) the amount of manual pressure applied with the calipers, (2) differences in the exact site that is picked for measurement, and (3) variations in fatness (i.e., more error in measurement occurs as the amount of fatness increases) (Keys and Brožek, 1953).

However, the test-retest reliability of skinfold measurements has been evaluated and it is high; correlation coefficients range from 0.92 to 0.98 (median 0.95 of seven coefficients) (see Keys and Brožek, 1953, p. 216).

Weight-for-Height Indices

For all weight-for-height indices, the reliability of the measures of weight and height is important. Reliability refers to the random error in measuring height and weight. This may occur through inaccuracy of self-reported measures or due to the poor reliability of the scale or measuring device used. For relative weight indices, the reliability of the reference weight is also relevant.

Weight and Height. The second Health and Nutrition Examination Survey (HANES II), which will be completed in 1980, assesses weight and height both by self-report and by actual measurement. Preliminary analyses of some of these data indicated that correlations between self-report and actual weight were all above 0.90. However, there was a digit preference in reported weights (i.e., a tendency to report in digits ending in 0 or 5) (Thomas F. Drury, NCHS, personal communication).

Reference Weight. In the studies that we reviewed, the most commonly used source of the average weight of Americans was the Build and Blood Pressure Study (Metropolitan Life Insurance Company, 1960; Society of Actuaries, 1959). Although these data are often cited as standards, they are of highly questionable reliability for the following reasons (see Society of Actuaries, 1959): (1) Weights were recorded in indoor clothing; (2) heights were recorded with shoes on; (3) there was a tendency to record weights ending with the digits 0 and 5 and heights in even inches; (4) there was no assurance that weights were measured using standard scales; (5) weight was recorded as reported by the insurance applicant in about 20 percent of the cases; and (6) height was recorded as reported by the applicant in about 90 percent of the cases.

A more reliable source of average weights is the National Health Examination Survey (NHES) data collected by the Public Health Service on a probability sample of the adult civilian noninstitutionalized population of the United States (USDHEW, 1966b, and USDHEW, 1979a). All measures in this study were collected using standardized techniques (e.g., weights were automatically recorded, and people were weighed in standard disposable paper examination uniforms).

VALIDITY OF MEASURES

We used several approaches to study the validity of measures of fatness and weight-for-height that were in the literature. Some pertain to all measures, and others are specific to some of the measures. Certain of our studies are based on data reported in the literature for purposes other than tests of the validity of the measures.

In order to be valid, all of the measures should be highly associated with independent measures of body fatness (Benn, 1971; Billewicz, Kemsley, and Thomson, 1962; Florey, 1970; Keys, Fidanza, Karvonen, et al., 1972). Weight-for-height measures should not be associated with height; that is, the value of the index should imply the same degree of fatness at all heights (Benn, 1971; Billewicz, Kemsley, Thomson, 1962; Khosla and Lowe, 1967; Florey, 1970; Keys, Fidanza, Karvonen, et al., 1972; Mann, 1974; James, 1976). All measures should be highly associated with weight (Khosla and Lowe, 1967; Florey, 1970).

Whenever data on height and weight are based on self-report, the extent of bias (e.g., underreporting of weight) is a significant validity issue. When relative weight indices are used, it is important to know whether the reference weight was obtained on a population comparable to the one of interest.

Finally, another approach to studying validity is to evaluate whether findings among multiple measures of weight and some other variable are consistent when more than one weight measure is used. We will address each of these approaches to studying validity below with respect to information obtained from a literature review.

Associations with Measures of Body Fatness

All of the measures of weight described in this report have been taken to be, often without justification, indirect or direct estimates of body fat. Body density is the most direct, as it takes into account both deep fat deposits and subcutaneous fat. Skinfold thickness is the next most direct, as it does measure fatness. However, it assesses only subcutaneous fat, which may average about half of the fat of the body (Ancel Keys, personal communication). In testing the validity of other measures of weight in relation to body fatness, we can use body density as a criterion measure in a somewhat hierarchical manner. First, we can validate measures of skinfold thickness against measures of body density. Once validity is established, we can use both body density and skinfold thickness measures as criterion measures (of body fatness) against which to test the validity of weight-for-height measures.

Body Density and Skinfold Thickness. We present a summary of correlations between measures of skinfold thickness and measures of body density in Table 1; we observed moderate to high correlations between measures of skinfold thickness and body density. The magnitude of the coefficients ranged from 0.65 to 0.85 with a median of 0.80 of 10 coefficients.

The measurement of skinfold thickness as an estimate of total body fat assumes that subcutaneous fat constitutes a constant or predictable proportion of total body fat (James, 1976). This may not be the case; it has been observed that as body fatness increases, more of the fat may be deposited subcutaneously. Further, the relationship between skinfold thickness and total body fat seems to vary with age and sex. As people age, the fat deposited deep inside increases (Keys and Brožek, 1953; Durnin and Womersley, 1974). In women, a larger proportion of fat is situated internally (Durnin and Womersley, 1974).

One problem in interpreting these validity coefficients is that the frequency distributions of measures of skinfold thickness are generally skewed, with a tail of high readings. To normalize the distribution of measures of skinfold thickness, many investigators use a logarithmic transformation (Seltzer and Mayer, 1965; Florey, 1970; Durnin and Womersley, 1974). In a plot of the relationship between skinfold thickness and body density, Durnin and Womersley observed that this transformation changed the association between skinfold thickness and body density to a linear one.

Despite these problems, the skinfold thickness measures appear to be valid indicators of body fatness. Thus, they can be used as criterion measures to assess the validity of weight-for-height indices. A caveat is in order, however, if one is to proceed step by step from one validity test to another in this manner. At best, it

Table 1

PRODUCT-MOMENT CORRELATIONS BETWEEN MEASURES OF BODY DENSITY AND SKINFOLD THICKNESS

Measure of Skinfold Thickness	Correlation with Body Density[a]	Sample	Reference
Triceps skinfold	-0.77	88 men aged 17-25	Pascale, Grossman, Sloane, et al., 1956
	-0.83	116 men "younger"	Brožek and Keys, 1951
	-0.65	214 men "older"	
Subscapular skinfold	-0.74	88 men aged 17-25	Pascale, Grossman, Sloane, et al., 1956
	-0.81	116 men "younger"	Brožek and Keys, 1951
	-0.68	214 men "older"	
Sum of triceps and subscapular skinfold	-0.85	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972
	-0.82	249 men aged 49-59	
	-0.79[b]	209 men aged 17-72	Womersley and Durnin, 1974
	-0.80[b]	272 women aged 16-68	

[a] Body density should be negatively correlated with skinfold thickness because density is negatively correlated with body fatness.

[b] Sum of four skinfold measures.

might be that the correlation between body density and the percentage of body weight represented by fat is r = 0.80 (Ancel Keys, personal communication). The correlation between skinfolds and density *approaches* r = 0.80, and in turn weight-for-height indices correlate with skinfolds something less than do skinfolds and body density. Thus, the amount of variance in body fat explained by less direct measures of body fat, even by ones that correlate well in the above sequence, is markedly reduced (Ancel Keys, personal communication).

Body Fatness and Weight-for-Height Indices. Because the measures of skinfold thickness appear to be valid indicators of body fatness, all body fatness measures (skinfold thickness and body density) can be used as criterion measures to assess the validity of the weight-for-height indices.

Product-moment correlations reported in the literature between the various weight-for-height indices and measures of body fatness are presented in Table B.1 in Appendix B; we provide a summary of the information in Table B.1 in Table 2.

Moderate to high correlations were observed between all of the weight-for-height indices and measures of body density and skinfold thickness. Although they are based on few studies, the median correlations of measures of body fatness with $H/\sqrt[3]{W}$ (0.68) and relative recommended weight (0.68) were slightly lower than the others (all about 0.75), indicating that these two measures are not quite as valid with respect to determining body fatness as are the other measures.

Table 2

SUMMARY STATISTICS[a] OF THE CORRELATIONS OF WEIGHT-FOR-HEIGHT MEASURES WITH BODY FATNESS MEASURES

	Body Fatness Measure							
	Body Density				Skinfold Thickness			
Weight/Height Measure	Number of Samples	Min.	Max.	Median	Number of Samples	Min.	Max.	Median
W/H	7	-0.57	-0.83	-0.72	17	0.42	0.83	0.75
W/H^2	7	-0.60	-0.85	-0.76	17	0.40	0.85	0.73
W/H^3 or $\sqrt[3]{W}/H$	4	-0.66	-0.79	-0.77	--	--	--	--
$H/\sqrt[3]{W}$	3	0.57	0.77	0.68	17	-0.36	-0.79	-0.66
Relative recommended weight (life insurance recommended)	--	--	--	--	6	0.60	0.74	0.68
Relative average weight	2	-0.63	-0.78	-0.71	15	0.56	0.86	0.77

[a] Summary of correlations in Table B.1.

A problem in interpreting these validity coefficients is that as the value of the index increases for some power-type indices, the variability of skinfold thickness increases, thus rendering the correlation coefficient of less value (Florey, 1970).

One problem with weight-for-height indices as indicators of body fatness is that they do not take account of the various proportions of fat, muscle, or bone in a person's weight. A person with a large bone structure or well-developed musculature may have a high weight relative to his height, yet would not be obese. Conversely, a fat person with small musculature or bone structure may have an average weight for his height.

Associations with Height and Weight

Product-moment correlations of the weight-for-height measures with height and weight are presented in Table B.2 in Appendix B.

Height. If a weight index is significantly correlated with height, and a variable being correlated with the index is also correlated with height, misleading results may occur.[5] Thus, a weight index should not be correlated with height.

Table 3 summarizes the information in Table B.2 regarding correlations of weight-for-height measures with height. In most samples, relative average weight was not highly associated with height. Of the power-type indices, for men, W/H^2 was the least correlated with height. For women, data on the correlation between

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[5] For example, in a study of the association between social class and weight, because social class is correlated with height (average height increases with social status), it is argued that persons in higher social classes are more obese or overweight (Billewicz, Kemsley, and Thomson, 1962).

Table 3

SUMMARY STATISTICS[a] OF THE CORRELATIONS OF WEIGHT-FOR-HEIGHT MEASURES WITH HEIGHT

Type of Measure	Sex	Number of Samples	Minimum	Maximum	Median
Relative average weight	M	12	0.04	0.32	0.09
W/H	M	26	0.17	0.51	0.27
W/H	F	2	0.03	0.27[b]	0.15
W/H^2	M	26	0.00[c]	0.25	0.02[d]
W/H^2	F	2	-0.03[b]	-0.20	-0.08[d]
W/H^3	M	10	-0.24	-0.36	-0.29
$H\sqrt[3]{W}$	M	16	0.10	0.47	0.29
$H\sqrt[3]{W}$	F	2	0.24[b]	0.41	0.32

[a] Summary of correlations in Table B.2.

[b] Based on a small sample (N=26).

[c] The minimum correlation was 0.00 but some negative correlations were reported (see Table B.2).

[d] Sign is taken into account in calculating the median (see Table B.2).

the power-type indices and height were available from only two samples. Because one of the samples was small ($N=26$), more consideration was given to the results from the larger sample ($N=2202$). In this larger sample, W/H^2 and $H/\sqrt[3]{W}$ were both somewhat correlated with height ($r = 0.20$ and 0.41, respectively), whereas W/H was not ($r = 0.03$).

The choice of which weight-for-height index should be used in a particular study could be based on the weight and height characteristics of the actual group being studied (Florey, 1970; Benn, 1971). Analyses could be performed to determine the value of p for which the W/H^p ratio will make W/H^p the least correlated with height. Florey (1970) performed such analyses on data collected on both men and women in the Framingham Study. He evaluated three power-type indices (W/H, W/H^2, $H/\sqrt[3]{W}$) and observed that the least change in the mean value of the power-type index as a function of height occurred for men using W/H^2 and for women using W/H. Florey also evaluated data from the NHES for women and again concluded that W/H was the best power-type index for use with women.

Goldbourt and Medalie (1974) regressed weight on height for several samples of men and concluded that W/H^2 was the best index for men.

Based on data collected on a national probability sample from the HANES, the best power-type index for men was W/H^2 and for women, $W/H^{1.5}$ (USDHEW, 1979b).

Thus, for men, W/H^2 was consistently found to be the optimal indicator with respect to this criterion. For women, either W/H or $W/H^{1.5}$ appear to be the best power-type indicator.

Weight. A weight-for-height measure should be highly associated with weight. A summary of the information in Table B.2 on the associations between measures of weight-for-height and weight is presented in Table 4. We observed high associations between both W/H and W/H^2 and weight for both men and women and only moderate associations between the ponderal indices (W/H^3 and $H/\sqrt[3]{W}$) and weight. No information on the association between relative weight indices and weight was found in the literature.

Table 4

SUMMARY STATISTICS[a] OF PRODUCT-MOMENT CORRELATIONS OF WEIGHT-FOR-HEIGHT MEASURES WITH WEIGHT

Type of Measure	Sex	Number of Samples	Minimum	Maximum	Median
W/H	M	12	0.96	0.97	0.97
W/H	F	1	0.97	0.97	0.97
W/H^2	M	12	0.83	0.86	0.85
W/H^2	F	1	0.90	0.90	0.90
W/H^3	M	10	0.60	0.68	0.67
$H/\sqrt[3]{W}$	M	2	-0.64	-0.64	-0.64
$H/\sqrt[3]{W}$	F	1	-0.77	-0.77	-0.77

[a] Summary of correlations in Table B.2.

Bias in Self-Reported Weight and Height Data

Self-reported height and weight may be inaccurate in two ways: random error, which is a threat to reliability; and a bias either to underreport or overreport, which is a threat to validity.

The Society of Actuaries studied biases in the self-reporting of weight and height and found that the average weights for various height and age groups of people who were actually weighed were greater than those reported by people not weighed. For people judged to be life insurance risks, weights were up to five pounds more for those who were actually weighed than for those who were not weighed. For people insured as substandard risks, weights were usually 10 pounds or more greater for those who were actually weighed than for those who were not (Society of Actuaries, 1959). For heights, the same analysis yielded a smaller discrepancy of about a half inch or less.

Reference Weight

The major criticism of relative weight indices as indicators of overweight relates to the validity of the reference weight. The use of either average or recommended weight is subject to criticism. When relative weight measures are used, it is important that the reference weight (either average or recommended) be based on a population that is comparable to the one being studied or one whose morbidity and premature mortality characteristics as a function of weight are known. Age, sex, and racial composition are all important variables that should be considered in deriving reference weights.

In the studies reviewed in this report, both average and recommended weights were usually taken from the Build and Blood Pressure Study (Metropolitan Life Insurance, 1960; Society of Actuaries, 1959). The Build and Blood Pressure Study sample is not representative of Americans, being a sample of people with life insurance policies (i.e., probably of higher socioeconomic status, Caucasian, and free of serious medical problems). Further, although they are labeled as "average" weights of men and women by the life insurance companies, they actually represent the average weights of only some of the persons insured by certain insurance companies (i.e., heights and weights are not even measured on many insurance applicants) (Keys, 1979).

A more representative (but because of its recency, less used) source of average weights for various age and sex groups is the NCHS data from a probability sample of the adult civilian noninstitutionalized population in the United States (USDHEW, 1979a). These standards may still not be completely adequate; that is, they may need to be separately derived for various racial groups in addition to age and sex.

As expected, the average weights obtained from different sources have been shown to differ somewhat. For instance, Seltzer (1965) found that the average weights in the Build and Blood Pressure Study (Metropolitan Life Insurance Company, 1960) were 9 to 10 pounds less for men and 3 to 4 pounds less for women than average weights obtained in the NHES for weight data reported for the years 1960 to 1962 (USDHEW, 1966b).

If average weight for persons of the same sex, age, and height is used (as opposed to recommended weight), the resulting index compares a person with a group that probably includes many overweight people. Thus, it may not accurately indicate overweight. Further, the average weight of a given population does not necessarily apply to other populations or even to the same population at another time (Keys, Fidanza, Karvonen, et al., 1972).

Finally, in the life insurance company tables, recommended weights are usually given for people with small, medium, and large body frames, but information is nonexistent on how to estimate frame size practically and reliably or what precisely is meant by frame size.

Consistency of Results among Measures of Weight and Fatness and Selected Health Outcomes

Another approach to evaluating the validity of measures of body fatness and weight-for-height is to determine if consistent conclusions are drawn regarding the relationship between weight (and fatness) and health when different measures are used. In a number of studies of such relationships, more than one type of measure of weight was used as an independent variable (e.g., skinfold thickness, W/H^2, and relative weight). A consistent conclusion would be, for example, that heart disease is related to overweight when W/H^2 is used as an indicator and also when relative average weight is used as an indicator of overweight. Table 5 summarizes the consistency of these relationships.

Table 5

CONSISTENCY OF RESULTS OF ASSOCIATIONS OF WEIGHT-FOR-HEIGHT AND BODY FATNESS MEASURES WITH CERTAIN HEALTH OUTCOMES WHEN DIFFERENT MEASURES OF WEIGHT ARE USED IN THE SAME STUDY

Weight Measures	Outcome[a]	Method of Analysis	Consistency of Results and Significance of Relationship	Sample and Follow-Up	Investigator
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease or definite myocardial infarction	1. Comparison of incidence in obese vs. nonobese 2. Comparison of incidence across quintiles of weight	Consistent (NS)[b] Consistent (NS)	2442 US men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease or definite myocardial infarction	1. Comparison of incidence in obese vs. nonobese 2. Comparison of incidence across quintiles of weight	Consistent (NS) Consistent (NS)	2439 Northern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease or definite myocardial infarction	Comparison of incidence of disease in obese vs. nonobese	Consistent (NS)	6518 Southern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease, definite myocardial infarction, angina pectoris, or clinical judgment of heart disease	Comparison of incidence of disease in obese vs. nonobese	Consistent (sig. $p < .05$)	2442 US men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease, definite myocardial infarction, angina pectoris, or clinical judgment of heart disease	1. Comparison of incidence in obese vs. nonobese 2. Comparison of incidence across quintiles of weight	Consistent (NS) Consistent (NS)	2439 Northern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease, definite myocardial infarction, angina pectoris, or clinical judgment of heart disease	1. Comparison of incidence in obese vs. nonobese 2. Comparison of incidence across quintiles of weight	Consistent (sig. $p < .01$) Consistent (sig. $p < .01$)	6518 Southern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972

Table 5—continued

Weight Measures	Outcome[a]	Method of Analysis	Consistency of Results and Significance of Relationship	Sample and Follow-Up	Investigator
Skinfold thickness W/H^2 Relative average weight	Angina pectoris or clinical judgment of heart disease	Comparison of incidence of disease across quintiles of weight	Consistent (sig. $p < .05$)	2442 US men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Angina pectoris or clinical judgment of heart disease	Comparison of incidence of disease across quintiles of weight	Consistent (NS)	2439 Northern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness Relative recommended weight	Angina pectoris	Comparison of mean weight or fatness in group of persons with disease compared to group without	Consistent (sig. $p < .05$)	7705 men aged 45-64 at entry (2 years of follow-up)	Kagan, Gordon, Rhoads, et al., 1975
Skinfold thickness Relative recommended weight	Myocardial infarction, death due to coronary heart disease or acute coronary insufficiency	Comparison of mean weight or fatness in group of persons with disease compared to group without	Consistent (sig. $p < .01$)	7705 men aged 45-64 at entry (2 years of follow-up)	Kagan, Gordon, Rhoads, et al., 1975
Skinfold thickness Relative recommended weight	Angina pectoris, myocardial infarction, death due to coronary heart disease or acute coronary insufficiency	Comparison of mean weight or fatness in group of persons with disease compared to group without	Consistent (sig. $p < .01$)	7705 men aged 45-64 at entry (2 years of follow-up)	Kagan, Gordon, Rhoads, et al., 1975
Skinfold thickness Relative average weight	Blood pressure	Correlation of blood pressure with weight	Consistent (coefficients not published)	5127 men and women aged 30-62 at entry (12 years of follow-up)	Kannel, Brand, Skinner, et al., 1967
Skinfold thickness Relative average weight	Subsequent development of hypertension	Comparison of prevalence of hypertension for various levels of weight or fatness	Consistent (effect observed, significance not reported)	5127 men and women aged 30-62 at entry (12 years of follow-up)	Kannel, Brand, Skinner, et al., 1967
Skinfold thickness W/H	Diabetes	Correlation of weight with incidence of diabetes	Consistent (sig. $p < .01$)	9494 men aged 40 and over at entry (5 years of follow-up)	Medalie, Papier, Herman, et al., 1974
Skinfold thickness W/H	Nonfatal myocardial infarction	Comparison of weight in group with disease compared to group without	Consistent (NS)	855 men aged 50 (10 years of follow-up)	Tibblin, Wilhelmsen, and Werko, 1975

Weight Measures	Outcome[a]	Method of Analysis	Consistency of Results and Significance of Relationship	Sample and Follow-Up	Investigator
Skinfold thickness W/H	Death due to ischemic heart disease	Comparison of weight in group with disease compared to group without disease	Consistent (NS)	855 men aged 50 (10 years of follow-up)	Tibblin, Wilhelmsen, and Werko, 1975
Skinfold thickness W/H	Death from other causes	Comparison of weight in group with disease compared to group without disease	Consistent (NS)	855 men aged 50 (10 years of follow-up)	Tibblin, Wilhelmsen, and and Werko, 1975
W/H^2 Relative recommended weight	Overall mortality	Comparison of incidence across quintiles of weight; multiple logistic function analysis	Consistent (sig. $p < .01$)	1233 men aged 40-59 at entry (14 years of follow-up)	Dyer, Stamler, Berkson, et al., 1975
W/H^2 Relative recommended weight	Death due to coronary heart disease	Comparison of incidence across quintiles of weight; multiple logistic function analysis	Significant relationship for W/H^2; no relationship for relative recommended weight	1233 men aged 40-59 at entry (14 years of follow-up)	Dyer, Stamler, Berkson, et al., 1975
W/H^2 Relative recommended weight	Death due to cardiovascular renal disease	Comparison of incidence across quintiles of weight; multiple logistic function analysis	Significant relationship for W/H^2; no relationship for relative recommended weight	1233 men aged 40-59 at entry (14 years of follow-up)	Dyer, Stamler, Berkson, et al., 1975
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart disease or definite myocardial infarction	Comparison of incidence across quintiles of weight	Significant effect of weight using W/H^2; no effect using skinfold thickness or relative average weight	6518 Southern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness W/H^2 Relative average weight	Death from coronary heart heart disease, definite myocardial infarction, angina pectoris, or clinical judgment of heart disease	Comparison of incidence of disease across quintiles of weight	Significant effect of weight using skinfold thickness and relative average weight; no effect using W/H^2	2442 US railroad men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972

Table 5—continued

Weight Measures	Outcome[a]	Method of Analysis	Consistency of Results and Significance of Relationship	Sample and Follow-Up	Investigator
Skinfold thickness W/H^2 Relative average weight	Angina pectoris or clinical judgment of heart disease	Comparison of incidence of disease across quintiles of weight	Significant effect using skinfold thickness and relative average weight; no effect using W/H^2	6518 Southern European men aged 40-59 at entry (5 years of follow-up)	Keys, Aravanis, Blackburn, et al., 1972
Skinfold thickness Weight, height	Angina pectoris, myocardial infarction or death from coronary disease	Comparison of weight in group with disease to group without disease	Significant difference in skinfold thickness; no difference in weight or height	5397 men aged 40-55 at entry (5 years of follow-up)	Paul, Lepper, Phelan, et al., 1963
$H/\sqrt[3]{W}$ Relative recommended weight	Overall mortality	Plot of mortality in relation to weight	$H/\sqrt[3]{W}$ curvilinearly related to mortality;[c] relative weight linearly related to mortality	Data from Build and Blood Pressure Study, 1959 (men and women)	Seltzer, 1966
Skinfold thickness Relative average weight	Coronary artery disease	Comparison of weight in group with disease to group without disease	Significant relationship with skinfold thickness; no relationship with relative weight	100 men aged 35-75	Sanders, 1959

[a] When multiple outcomes are specified, "incidence" is defined as any one of these multiple outcomes.

[b] NS = not significant.

[c] As weight increases, mortality increases only slightly up to a ponderal index of about 12.3. At that point, increases in weight result in very sharp increases in mortality.

Eleven different samples of people were studied and 30 relationships between weight (or fatness) and a variety of health outcomes (e.g., sudden death from coronary artery disease) were analyzed. Conclusions regarding the relationship between weight (or fatness) and health were consistent for all measures of weight and fatness that were used in 22 of the 30 tests.

Unfortunately, all but one of the studies summarized in Table 5 are of men only. Because measures of weight-for-height may have a different validity for women, the above results may not be generalizable to studies that include women.

CRITERIA USED BY OTHERS TO DEFINE OVERWEIGHT AND OBESITY

Although all of the measures described above are continuous variables, it may be of interest in some analyses to define a group or groups as overweight or not overweight. Thus, a criterion or cutoff point is sometimes needed for each of the measures. However, no satisfactory standards for determining such a cutoff point currently exist (Bray, 1979).

There are three ways such a cutoff point can be determined. One is to establish the point in weight (or fatness) at which adverse effects on health status sharply increase. As will be seen in Section IV, such a point occurs for a few diseases (e.g., diabetes) but is not clearly observed for most others. Another way to determine a cutoff point is to define overweight or obesity in terms of some percentage above "normal" weight or fatness. However, there are no universally accepted criteria of "normal" weight or fatness. A third way to define groups of overweight or obese people is to establish groups based on the distribution of the measure in a defined population, that is, establish quintiles or deciles of weight or fatness.

The use of cutoff points can cause confusion if people think of them as identifying critical levels of weight above which one will be "abnormal." Thus, attention should be focused on their somewhat arbitrary definition.

Body Fatness

Body Density. We found no criteria in the literature for determining obesity from measures of body density.

Skinfold Thickness. Jolliffe (1963; see USDHEW, 1966a, p. 12) suggests that for individuals with normal amounts of fat, the skinfold thickness (triceps or subscapular) should be no more than one-half to one inch, indicating a layer of subcutaneous fat of from one-fourth to one-half inch thick. Seltzer and Mayer (1965) have recommended that people under 30 be classified as obese if the triceps skinfold is greater than the mean plus one standard deviation for people of their age. For people aged 30 to 50, the mean plus one standard deviation for 30 year olds should be used as the cutoff point. A table of minimum triceps skinfold thickness for use as cutoff points in labeling people aged 5 to 50 is available in Seltzer and Mayer. For example, for men aged 30 to 50, the minimum skinfold thickness indicating obesity is 23 mm; for women aged 30 to 50 it is 30 mm.

The criterion used to define obesity for people aged 20 to 74 in the HANES was a triceps skinfold thickness greater than the value obtained at the 85th percentile for people aged 20 to 29 (USDHEW, 1975a).

In addition, a sum of triceps and subscapular skinfolds of 36 mm or greater has been used to define obesity in a population of men aged 40 to 59 (Keys, Aravanis, Blackburn, et al., 1972).

Weight-for-Height Indices

Relative Weight Indices. The criteria for overweight using measures of relative weight vary. Some investigators consider 10 percent above the reference weight as overweight, others use 20 percent, and still others use a higher percentage (USDHEW, 1966a). Some report data for several cutoff points (e.g., ≥ 110, ≥ 120).

Power-Type Indices. Criteria of overweight based on power-type indices have rarely been stated. A cutoff point of 27 has been used for W/H^2 (weight in kilograms and height in meters) by Keys, Aravanis, Blackburn, et al. (1972). James (1976) concluded that the following values of W/H^2 (kg/m^2) are comparable to a relative recommended weight (life insurance recommended) equal to 120:

	W/H^2 (kg/m^2)	
Body Frame	Men	Women
Medium frame	27.5	27.0
Large frame	29.9	29.5

Three categories of weight were defined by Billewicz, Kemsley, and Thomson (1962) for the ponderal index $H/\sqrt[3]{W}$ (inches/$\sqrt[3]{\text{pounds}}$) to assess differences in weight as a function of social status: Heavy was 12.2 or less, average was 12.2 to 12.7, and light was 12.7 or more. The cutoff point of $H/\sqrt[3]{W} = 12.5$ was characterized as "a strong measure of outright obesity" by Paffenbarger, Notkin, Krueger, et al. (1966).

SUMMARY AND CONCLUSIONS

The following types of measures of weight and body fatness were reviewed:

- Body fatness
  - Body density
  - Skinfold thickness
- Weight-for-height
  - Relative weight
    - Relative average weight
    - Relative recommended weight
      - Life insurance recommended
      - NCHS recommended
  - Power-type indices
    - W/H
    - $W/H^{1.5}$
    - W/H^2
    - W/H^3
    - $\sqrt[3]{W}/H$
    - $H/\sqrt[3]{W}$

For each of these, a criterion can be established by which excess body fatness (obesity) or excess weight (overweight) can be defined.

The reliability of measures of body fatness is high in the few studies in which it was evaluated. We found almost no information on the reliability of measures of weight and height (they are most likely high and we will address this issue later using HIS data). Of the two most common sources of average weights, one is of questionable reliability (Metropolitan Life Insurance Company, 1960) because of the nonsystematic way in which data were collected. The other used standardized techniques and is probably a very reliable source of information about weight (USDHEW, 1979a).

Only a few studies have been conducted on the validity of skinfold thickness and weight-for-height measures in relation to their effectiveness in measuring body fatness. However, those studies that are available show consistent results, thus giving some credence to the following conclusions. Most of the studies of the relationship of measures of body fatness and weight-for-height indices, however, have been performed on men only. Because in the few studies that have included men and women, results vary some according to sex, the following conclusions may be more certain for men than for women:

1. In spite of the problems noted with respect to the measurement of skinfold thickness, under most circumstances they appear to be valid indicators of the fat content of the body.
2. Power-type indices are slightly preferred to relative weight indices, primarily because of the difficulties in determining a reference weight. Nevertheless, relative average weight correlates as well with measures of body fatness as do some power-type indices; it also has among the lowest correlations with height.
3. The best power-type index of weight is the one determined for the population of interest to be most independent of height for that population. If such analyses cannot be performed, the measure of weight for men that best meets all of the validity criteria is W/H^2. For women, W/H or $W/H^{1.5}$ appears to be a better index than W/H^2. Measures that did least well for men and women were the various ponderal indices (W/H^3, $\sqrt[3]{W}/H$, and $H/\sqrt[3]{W}$).
4. Finally, because consistent findings regarding the association of weight or fatness and health were observed in a number of studies that used different measures of weight or fatness, the conclusion that all of the measures of weight are useful is now reemphasized.

III. PREVALENCE OF OVERWEIGHT AND OBESITY AS REPORTED IN THE LITERATURE

INFLUENCE OF KNOWN EFFECTS

Reporting the prevalence of overweight and obesity is complicated because of the many variables involved. Prevalence estimates vary as a function of

1. Age of the population
2. Sex of the population
3. Socioeconomic status (income, education, occupation) of the population
4. Types of measure used (e.g., relative weight, skinfold thickness)
5. Criterion of overweight or obesity

Thus, before we can discuss the prevalence of overweight or obesity in a general population, we must describe the known effects of these characteristics on overweight and obesity.

Age, Sex, and Weight

Several studies (both cross-sectional and longitudinal) indicate that for both men and women, the trend is for weight to increase as a function of age until middle age, level off for a few years, and then decline at older ages (Metropolitan Life Insurance Company, 1960; Moore, Stunkard, and Srole, 1962; Goldbourt and Medalie, 1974; Kannel and Gordon, 1974; Hsu, Mathewson, and Rabkin, 1977; USDHEW, 1976).

Body fatness also increases as a function of age, although to different degrees for men and women. In young white women, the percentage of total weight due to body fat is 26, increasing in a linear manner to about 38 in older white women (Chen, 1953; Durnin and Womersley, 1974). Young white men (age 16 to 19) are 15 percent fat, increasing to 28 percent in older men (age 50 to 72) (Durnin and Womersley, 1974). Chen (1953) found young white men to be about 11 percent fat, increasing to 21 percent in middle-aged white men.

Women who were born earlier in the century tend to be heavier at a given age than women born later (Kannel and Gordon, 1974; Brožek, 1960). In comparing the average weight of women in life insurance company studies conducted in 1912 with those conducted in 1959, women in 1959 weighed up to six pounds less than women of comparable age in 1912 (Brožek, 1960). For men, the weight trend is opposite to that of women. Men born earlier in this century tend to be lighter than men born later (Kannel and Gordon, 1974; Brožek, 1960; Baird, Silverstone, Grimshaw, et al., 1974; Hsu, Mathewson, and Rabkin, 1977), with the average weight of men of similar age and height increasing from one to eight pounds between 1912 and 1959 (Brožek, 1960). It should be noted that all of these studies were done using nonrepresentative samples of Americans and Britons.

Socioeconomic Status

The relationship between socioeconomic status and weight depends on sex. It can also be misleading if an index of weight is used that is correlated with height (such as the ponderal index). Because women in lower socioeconomic classes are shorter, such an index gives misleading results.[1]

Women. Women in lower social classes are consistently more overweight. Women college graduates are found to weigh less (defined in terms of relative average weight) than less educated women (Kannel, Pearson, and McNamara, 1969). The prevalence of overweight, defined in terms of categories of height and weight, was higher (30 percent) among women raised in the lowest social class category than among women raised in the highest social class category (4 percent) (Moore, Stunkard, and Srole, 1962). Women in lower socioeconomic groups were more likely to be overweight, defined in terms of relative recommended weight—life insurance recommended ≥ 120 (72 percent), than women in upper socioeconomic groups (39 percent) (Silverstone, 1970). Women in lower social classes had a higher W/H^2 and higher average weights than women in upper social classes (Baird, Silverstone, Grimshaw, et al., 1974).

Men. The relationship between socioeconomic status and weight is less clear for men. In one study, no association was observed between weight and social class using measures of W/H^2 and average weight (Baird, 1974). In another study, the prevalence of overweight was slightly higher among men raised in the lowest social class (30 percent) than those raised in the highest social class (20 percent) (Moore, Stunkard, and Srole, 1962). A slight trend was observed of fewer overweight, defined in terms of relative recommended weight—life insurance recommended ≥ 120, in the upper social classes (26 percent) than in the lower social classes (37 percent) (Silverstone, 1970). Finally, Goldbourt and Medalie (1974) found an inverted U effect; men with either no schooling or partial elementary school and men with a university education tended to weigh less (measured as W/H^2) than other men. They also found that professionals and laborers weighed least, while technicians, administrative, and clerical workers weighed most.

Types of Measures and Criteria Used

Estimates of the prevalence of overweight vary according to the type of measure employed and the criteria used to define overweight or obesity. Higher estimates of prevalence are obtained if relative recommended weight is used than if relative average weight is used as the measure. This is because relative average weights are based on average weights for specified age groups. If the age group as a whole is heavy, a person who is overweight may be "average." For example, in the Build and Blood Pressure Study (Metropolitan Life Insurance Company, 1960), the prevalence of overweight based on a criterion of relative average weight ≥ 120 percent is estimated at from 5 to 7 percent for women across five age groups and from 9 to 12 percent for men across five age groups. When estimates are based on a criterion of relative recommended weight ≥ 120 percent, estimates of overweight jump substantially, especially in older age groups. For women, estimates of percentage overweight range from 12 for those aged 20 to 29 to 46 for those aged 50 to 59. For men, the values range from 12 percent for those aged 20 to 29 to 34 for those aged 50 to 59. It is difficult to compare prevalence of overweight among studies because a particular study often uses different types of measures of overweight or obesity.

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[1] Billewicz, Kemsley, and Thomson (1962) demonstrated how an observed association between weight and social class can be spurious. Using the ponderal index, they presented data showing that women are more overweight in the lower classes. When adjustments for height were made, however, the association disappeared.

In such studies, however, if similar estimates of prevalence of overweight are observed across measures for specified cutoff points, the points may be used to define comparable levels of overweight or obesity. For example, one study of men aged 40 to 59 used three measures of overweight or obesity (cutoff point in parentheses): relative average weight (≥ 110 percent); W/H^2 (≥ 27.0, kg/m^2); and sum of triceps and subscapular skinfolds (≥ 36 mm). Prevalence of overweight or obesity of 23.2, 22.3, and 20.5 percent, respectively, was observed (Keys, Aravanis, Blackburn, et al., 1972).

Another study of men aged 40 to 59 used two measures: relative recommended weight (life insurance recommended) and W/H^2 (kg/m^2). For relative recommended weight ≥ 125 and $W/H^2 \geq 27.4$, prevalences of overweight of 37.7 and 38.4 percent, respectively, were observed (Dyer, Stamler, Berkson, et al., 1975).

PREVALENCE

Most studies that estimate the prevalence of overweight in general populations use measures of relative recommended weight—life insurance recommended (RRWL) and a criterion of ≥ 120 or ≥ 125 percent to define people as overweight. Although RRWL is not the best measure of overweight, we have summarized the prevalence for various age groups in terms of this measure (see Table 6) because more data are available for RRWL than for other measures. In addition, a summary of estimates of the prevalence of overweight in men aged 40 to 59 using W/H^2 is shown in Table 7.

For both measures, at least for the criteria used, the most obvious conclusion is that the prevalence of overweight is high in all samples. Estimates across all ages for both men and women using RRWL indicate that from about one-seventh to one-half of the population is overweight.

In addition, again using RRWL, the prevalence of overweight for people under age 30 is notably less than for those over age 30. For all age and sex groups, however, the prevalence of overweight is sufficiently high that if prevalence is affected by a person having generous health insurance, such an effect should be observable in the HIS.

Table 6

Estimates of the Prevalence of Overweight Using Measures of Relative Recommended Weight

Age Group	Percent Women	 Men	Definition of Recommended Weight[a]	Criterion	Total Sample Characteristics[b]	Year Data Collected	Reference
Selected Groups							
15-29	7.5	6.2	Life insurance	≥ 120	Nearly representative sample of 1334 residents of a London borough	1971-1973	Baird, Silverstone, Grimshaw, et al., 1974
20-24	9.6	7.4	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
20-29	12.0	12.0	Life insurance	≥ 120	Persons insured as standard risks; biased in favor of higher socioeconomic groups	1959	Metropolitan Life Insurance Company, 1960
25-34	17.1	13.6	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
30-39	25.0	25.0	Life insurance	≥ 120	Persons insured as standard risks; biased in favor of higher socioeconomic groups	1959	Metropolitan Life Insurance Company, 1960
30-49	17.3	18.0	Life insurance	≥ 120	Nearly representative sample of 1334 residents of a London borough	1971-1973	Baird, Silverstone, Grimshaw, et al., 1974
35-44	24.3	17.0	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
40-49	40.0	32.0	Life insurance	≥ 120	Persons insured as standard risks; biased in favor of higher socioeconomic groups	1959	Metropolitan Life Insurance Company, 1960
40-49	(c)	39.5	Life insurance	≥ 125	1233 employees of Chicago Peoples Gas Company	1958	Dyer, Stamler, Berkson, et al., 1975
45-54	27.8	15.8	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
50-59	46.0	34.0	Life insurance	≥ 120	Persons insured as standard risks; biased in favor of higher socioeconomic groups	1959	Metropolitan Life Insurance Company, 1960
50-59	(c)	36.2	Life insurance	≥ 125	1233 employees of Chicago Peoples Gas Company	1958	Dyer, Stamler, Berkson, et al., 1975
50-65	31.6	18.2	Life insurance	≥ 120	Nearly representative sample of 1334 residents of a London borough	1971-1973	Baird, Silverstone, Grimshaw, et al., 1974
55-64	34.7	15.1	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
60-69	45.0	29.0	Life insurance	≥ 120	Persons insured as standard risks; biased in favor of higher socioeconomic groups	1959	Metropolitan Life Insurance Company, 1960
65-74	31.5	13.4	NCHS	≥ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b

Table 6--continued

Age Group	Percent Women	Percent Men	Definition of Recommended Weight[a]	Criterion	Total Sample Characteristics[b]	Year Data Collected	Reference
All Ages							
20-74	23.8	14.0	NCHS	$\geq$ 120	13,131 persons, national probability sample of the United States	1971-1974	USDHEW, 1979b
20-59	49.0	37.0	Life insurance	$\geq$ 120	391 patients of general practitioners in London	1966-1967	Silverstone, 1970
18-79	28.8	29.6	Life insurance	$\geq$ 120	Representative sample of United States	1960-1962	Kannel and Gordon, 1974, based on data published in USDHEW, 1966b
36-[illegible]	(c)	37.2	Life insurance	$\geq$ 120	4654 white Jewish men in New York metropolitan area	1957	Spain, Nathan, and Gellis, 1963
16 and older	27.3	18.5	Life insurance	$\geq$ 120	Probability sample of about 7000 residents of Alameda County, California	1965	Belloc and Breslow, 1972

[a] Life insurance recommended is the weight at which a person has the best chance of survival. NCHS recommended is the mean weight of people aged 20 to 29. (See Section II for a further discussion of these measures.)

[b] Sample size if reported when available.

[c] Women are not included in this study.

Table 7

ESTIMATES OF THE PREVALENCE OF OVERWEIGHT IN MEN AGED 40 TO 59 USING MEASURES OF W/H²

Age	Percent (men only)	Criterion (W/H^2)	Sample Characteristics	Year Data Collected	Reference
40-59	38.4	$\geq$ 27.4	1233 male employees of Chicago Peoples Gas Company	1958	Dyer, Stamler, Berkson, et al., 1975
40-59	23.1	$\geq$ 27.0	6519 Southern European men	1958-1964	Keys, Aravanis, Blackburn, et al., 1972; and Keys, 1980
40-59	13.0	$\geq$ 27.0	2439 Northern European men	1959-1960	
40-59	29.5	$\geq$ 27.0	2442 U.S. railroad men	1958-1960	

IV. RELATIONSHIP BETWEEN OVERWEIGHT (AND OBESITY) AND HEALTH

In this section we review the literature on the relationship between overweight (and obesity) and health status. In particular, we examine both (1) the relationship between overweight (and obesity) and various measures of health, and (2) the relationship between a reduction in weight among the overweight and components of their subsequent health status.

OVERWEIGHT (AND OBESITY) AND HEALTH

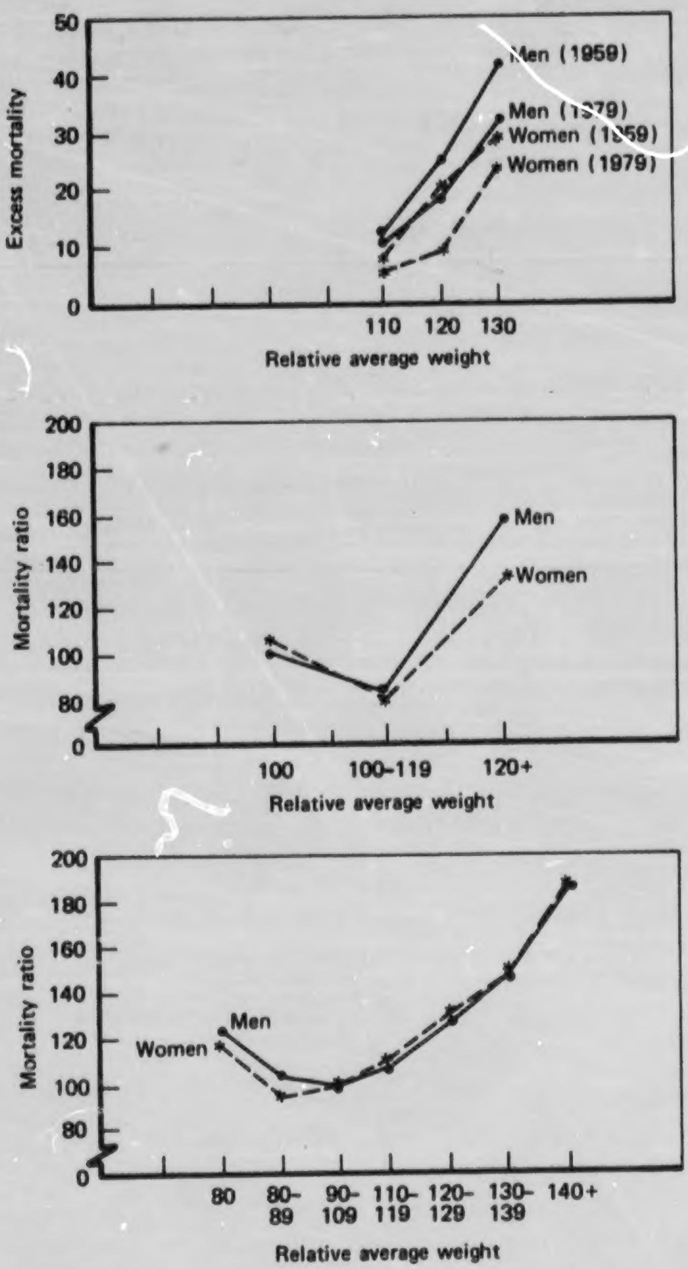
We reviewed 21 studies of the relationship between overweight (and obesity) and health for the following major health status outcomes: overall premature mortality; incidence of mortality and morbidity due to heart disease (coronary heart disease, sudden death, angina pectoris, myocardial infarction, and coronary artery disease); incidence and mortality due to diabetes; and levels of blood pressure and serum cholesterol.

We reviewed 21 studies to assess the association between health status and overweight (and obesity). Of these, 14 were prospective studies, 6 were cross-sectional, and one was retrospective. Eleven of the studies were of men only. Measures of weight and fatness were obtained by examination in 17 studies, by self-report in two studies, and by a mixture of these in one study (the method was unspecified in one study). Multivariate analyses (i.e., analyses controlling for the effects on health of other important variables such as smoking) were performed in seven of the studies, although these varied in the number of variables so controlled.

These 21 studies were generally of high quality. However, in reading the data that are presented in this section, the reader should pay more attention to findings from (1) those studies that controlled for blood pressure, serum cholesterol, and smoking when the effect of weight on health was examined; and (2) studies that, because of selection effects, used data other than those obtained from the life insurance companies. In interpreting the results presented below, we also have attempted to give more weight to those studies that were prospective, actually measured weight and fatness, and controlled for other important variables (especially blood pressure, serum cholesterol, and smoking).

Overall Premature Mortality

Figures 1, 2, and 3 present a summary of trends of the effect of weight on overall premature mortality. In the figures, weight is defined, respectively, as relative average weight, deciles of relative average weight, and relative recommended weight—life insurance recommended. Premature mortality was defined in one of six ways: (1) as excess mortality, which is the percent mortality in excess of that of people insured as standard risks (Metropolitan Life Insurance Company, 1960); (2) as a mortality ratio, which refers to the number of observed cases for each weight category divided by the number of expected cases multiplied by 100, where

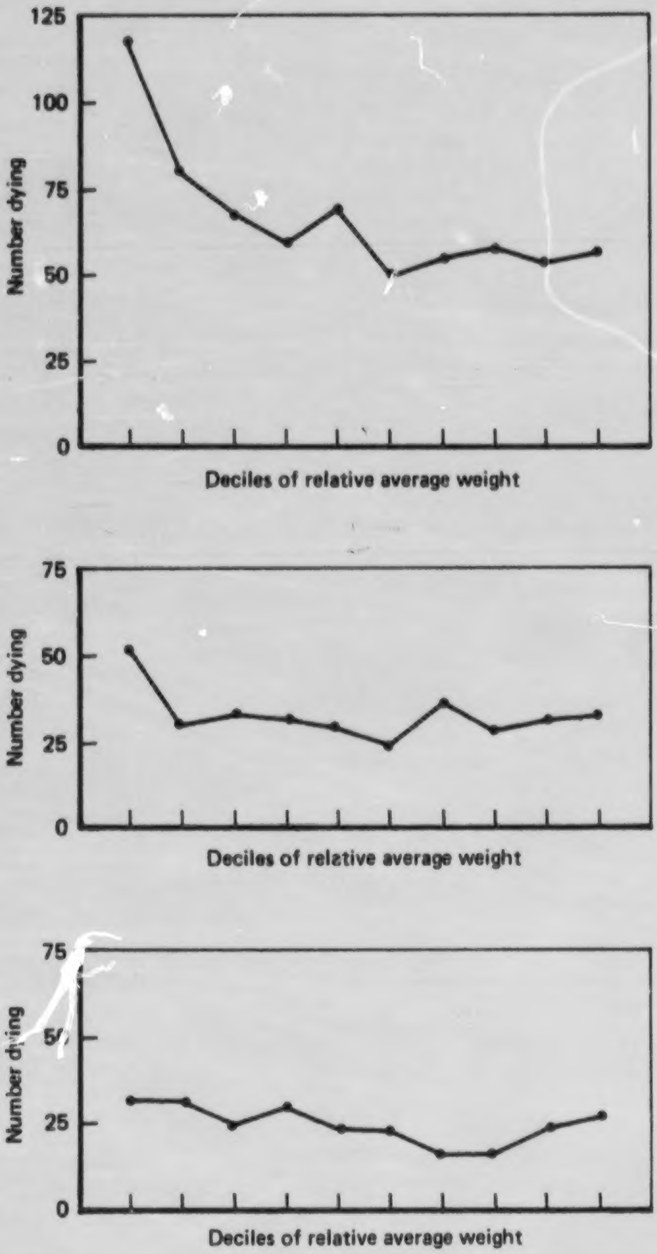


1 to 22 years' follow-up
(follow-up time represents number of years insured)
Build and Blood Pressure Study
3,900,000 people aged 15-69 at time of policy issue in 1959 study; 4,000,000 people in 1979 study
(Metropolitan Life Insurance Company, 1960; Society of Actuaries, 1979)

8 years' follow-up
Framingham Study
5209 people aged 30-59
(Kannel, Pearson, and McNamara, 1969)

13 years' follow-up
American Cancer Society Study
750,000 people aged 30+
(Lew and Garfinkel, 1979)

Fig. 1—Overall premature mortality as a function of relative average weight

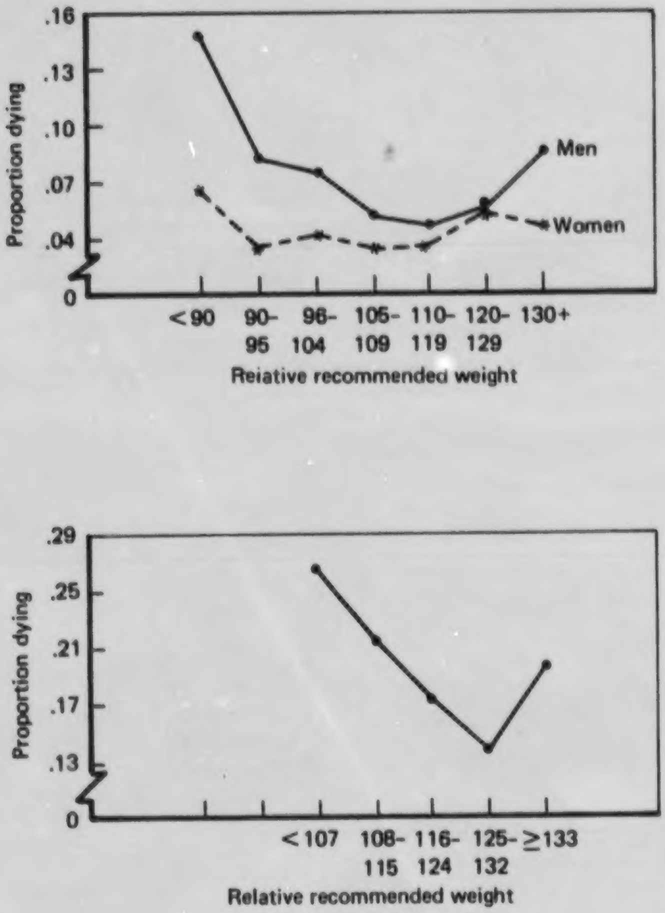


10 years' follow-up
Seven countries study
6567 Southern European men
aged 40-59
(Keys, 1980)

10 years' follow-up
Seven countries study
2484 Northern European men
aged 40-59
(Keys, 1980)

10 years' follow-up
Seven countries study
2454 U.S. railroad men
aged 40-59
(Keys, 1980)

Fig. 2—Overall premature mortality as a function of deciles of relative average weight



5½ years' follow-up
Alameda County Study
6928 people aged 18+
(Belloc, 1973)

14 years' follow-up
Chicago Peoples Gas Co. Study
1233 men aged 40-59
(Dyer, Stamler, Berkson, et al., 1975)

Fig. 3—Overall premature mortality as a function of relative recommended weight—life insurance recommended

the number of expected cases were based on the total sample (Kannel, Pearson, McNamara, 1969; Seltzer, 1966); (3) as a mortality ratio as in (2) but where the number of expected cases were based on those in the 90-109 weight index category (Lew and Garfinkel, 1979); (4) as the number dying in ten years of follow-up (Keys, 1980); (5) as the proportion dying in the five and one-half years of follow-up (Belloc, 1973); and (6) as the mortality rate per 1000 in 14 years (Dyer, Stamler, Berkson, et al., 1975).

Weight was measured by self-report in two studies (Belloc, 1973; Lew and Garfinkel, 1979); by actual measurement in three studies (Dyer, Stamler, Berkson, et al., 1975; Kannel, Pearson, and McNamara, 1969; Keys, 1980); and by varied methods in the life insurance company studies.

Additional data on the relationship between weight and overall mortality are provided by two recent studies. In one, analyses of data from the Framingham

Study revealed that the minimum mortality was observed around the average weight (where average was defined in terms of body build groups suggested by the Build and Blood Pressure Study), and increased mortality was observed for people weighing more or less than the average (Sorlie, Gordon, and Kannel, 1980). In the second study of a group of 200 overweight men (average weight 316.4 pounds) who were followed for 2 to 8 years, "markedly higher" mortality was observed in all age groups compared with mortality in the U.S. male population; the differences were greatest for the age group 25 to 34 (12-fold excess mortality) and diminished as age increased (Drenick, Bale, Seltzer, et al., 1980).

Generally, based on data discussed above and reported in the figures, both underweight and overweight people experience higher overall premature mortality than people of normal (either average or recommended) weight; that is, the relationship between overall mortality and weight is U-shaped. There seems to be a sharp increase in mortality at extremely high weights (when RAW is greater than 120 and when RRWL is greater than 130).

The finding that underweight people are at risk is relatively new; it has been commonly believed that the more one weighed, the greater the risk of death. A number of explanations for this finding have been suggested. When the follow-up period is relatively short, the finding that underweight people have higher premature mortality rates than people of normal weight could be explained by the fact that loss of weight is often a symptom of illness, and thus people who are already ill on entry into a study (and subsequently die) are more likely to be thin. Evidence for this explanation is provided by one analysis of people who lost a large amount of weight; for those whose weight loss was preceded by illness, mortality in the follow-up period was four times as high as for those who deliberately dieted to lose weight (Kannel and Gordon, 1974). However, this cannot be the entire explanation because the association of underweight and mortality persists even when the follow-up period is quite long (Dyer, Stamler, Berkson, et al., 1975; Lew and Garfinkel, 1979); when people with definite clinical evidence of potentially lethal disease are excluded (Sorlie, Gordon, and Kannel, 1980); and when people who had lost 10 pounds or more in the preceding year were excluded (Lew and Garfinkel, 1979).

Another explanation is that underweight people have subclinical disease or are perhaps more susceptible to disease because of inadequate diet. This was tested by Sorlie, Gordon, and Kannel (1980) by evaluating the relationship between relative average weight and overall mortality in the 13th through 24th years following weight measurement (i.e., eliminating the first 12 years as the time in which subclinical disease might cause mortality). In this analysis, the finding that underweight people experience higher mortality than normal weight people persisted for men, but not for women. The data thus do not definitely answer the question as to whether being underweight is a result of disease or predisposes people to disease, but evidence especially for men indicates that underweight as well as overweight men are at higher risk.

Heart Disease

We present a summary of the relationship between overweight (and obesity) and several manifestations of heart disease in Table 8. Manifestations of heart disease include mortality due to coronary heart disease, sudden death, myocardial infarction, angina pectoris, and coronary artery disease. Each of these manifesta-

Table 8

RELATIONSHIP BETWEEN OVERWEIGHT (AND OBESITY) AND VARIOUS MANIFESTATIONS OF HEART DISEASE

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Mortality due to coronary heart disease	Mortality was greater in overweight and underweight men. Using a multiple logistic function analysis, this effect remained after controlling for age, number of cigarettes smoked, systolic blood pressure, and serum cholesterol	Initial W/H^2 — Mortality Rate/1000 ≤ 23.5 — 95 23.6 - 25.6 — 63 25.7 - 27.3 — 76 27.4 - 29.2 — 48 ≥ 29.3 — 73 (quadratic trend significant, $p < .03$) Quadratic trend remained significant ($p < .01$)	14	Chicago Peoples Gas Co. Study, 1233 men aged 40-59 at entry	Dyer, Stamler, Berkson, et al., 1975
	Mortality increased as weight increased except for the low weight group	Initial RAW (based on self-report) — Mortality Ratio: Men — Women <80 — 1.25 — 1.19 80 - 89 — 1.05 — 0.96 90 - 109 — 1.00 — 1.00 110 - 119 — 1.15 — 1.17 120 - 129 — 1.27 — 1.29 130 - 139 — 1.46 — 1.46 140+ — 1.87 — 1.89	13	American Cancer Society Study, 750,000 people aged 30 and older	Lew and Garfinkel, 1979
	Weight was greater in men who died than in men who did not	— Decedents — Controls Mean weight $(H/\sqrt[3]{W})^b$ — 13.08 — 13.19 ($p < .05$) Percent overweight $(H/\sqrt[3]{W} \leq 12.5)$ — 17.00 — 10.00 ($p < .05$)	30 (retrospective)	45,000 male former college students	Paffenbarger, Notkin, Krueger, et al., 1966
	Mortality was greater in overweight men than underweight men	RWWL at Most Recent Exam — Age Adjusted Average Annual Deaths/10,000 65 - 99 — 25 140 - 272 — 42 (significance not tested)	Unspecified (weight at most recent exam)	Framingham Study, 5209 people aged 45-74 at most recent exam	Kannel and Gordon, 1974
	Mortality was greater in a group of overweight men than in the U.S. male population.	— Percent Dying Overweight men (mean weight = 316 pounds) — 56.0 U.S. male population — 40.3	2-8	200 overweight men	Drenick, Bale, Seltzer, et al., 1980

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Mortality due to coronary heart disease (cont.)	No effect in women	Age adjusted average annual coronary deaths/10,000 was the same for overweight as for nonoverweight women	Unspecified (weight at most recent exam)	Framingham Study, 5209 people aged 45-74 at last exam	Kannel and Gordon, 1974
	No effect in men	No differences in initial mean weight (W/H^2) and fatness (sum of skinfolds) between the group who died of fatal acute ischemic heart disease and the group that did not	12.5	855 men aged 50	Lar[illegible]on, 1978
	No effect in men	No effect of quintiles of weight (RRWL) on rate/1000	14	Chicago Peoples Gas Co. Study, 1233 men aged 40-59 at entry	Dyer, Stamler, Berkson, et al., 1975
	No effect in men controlling for age, blood pressure, serum cholesterol, smoking, and resting pulse rate	Using a multiple logistic analysis, W/H^2 was not significant either linearly or quadratically	10	93 U.S. railroad men aged 40-59 at entry; 91 Northern European men aged 40-59 at entry; 72 Southern European men aged 40-59 at entry	Keys, 1980
Sudden death[c] within 24 hours	Mortality increased directly as weight increased	Initial W/H^2[d] — Mortality Ratio[e] ≤ 22.5 — 55 22.6 - 25.0 — 95 25.1 - 27.5 — 142 ≥ 27.6 — 185	26	Manitoba Study, 3983 men aged 15-6[illegible] at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
	Mortality increased as weight increased, controlling for age and blood pressure	Using a multiple logistic function analysis, weight (W/H^2) remained significant ($p < .01$)			
	Weight was greater in cases than in noncases	Mean Initial W/H^2[d] Cases — Noncases 25.3 — 23.6 ($p < .01$)			
Sudden death within one hour	Mortality was greater for overweight than for nonoverweight men, and slightly greater for underweight than for nonoverweight	Initial RAW — Mortality Ratio < 90 — 84 90 - 109 — 68 110 - 119 — 98 < 120 — 344	12	Framingham Study, men aged 30-59 at entry	Kannel, LeBauer, Dawber, et al., 1967

Table 8—continued

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Sudden death within one hour (cont.)	Incidence was greater in overweight than in underweight men; no effect in women	RRWL at Most Recent Exam / Age Adjusted Average Annual Deaths/10,000: Men, Women 65 - 99: 12.8, 3.1 160 - 262: 25.6, 4.3 (significance not tested)	Unspecified (weight at most recent exam)	Framingham Study, 5209 people aged 65-74 at most recent exam	Kannel and Gordon, 1974
	No effect	Using bivariate regression (accounting only for age), weight (RRWL) did not predict incidence for men or women			
Myocardial infarction (MI)					
New MI	Incidence increased as weight increased	Initial W/H²[d] / Morbidity Ratio[e] ≤22.5: 68 22.6 - 25.0: 108 25.1 - 27.5: 112 ≥27.6: 135 (significance not tested)	26	Manitoba Study, 3983 men aged 15-64 at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
	Incidence increased as weight increased, controlling for age and blood pressure	Using a multiple logistic function analysis, weight (W/H²) remained significant (p < .01)			
	Weight was greater in cases than in noncases	Mean Initial W/H²[d]: Cases, Noncases 24.7, 23.6 (p < .01)			
MI or death due to MI	No effect	No difference in rates of disease between overweight (RRWL ≥ 120) and nonoverweight people	6	1336 people aged 25-64 at entry	Pell and D'Alonzo, 1963
	No effect	Using bivariate regression (accounting only for age), weight (RRWL) did not predict incidence for men or women	Unspecified (weight at most recent exam)	Framingham Study, 5209 people aged 65-74 at most recent exam	Kannel and Gordon, 1974

<table>
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<tr><th>Manifestation of Heart Disease/Definition</th><th>Nature of Relationship</th><th>Method and Data Regarding Effect[a]</th><th>Years of Follow-Up</th><th>Population</th><th>Reference</th></tr>
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<tr><td>MI or death due to to MI (cont.)</td><td>No effect</td><td>No effect comparing initial weight (W/H^2) or fatness (sum of skinfolds) for cases vs. noncases</td><td>12.5</td><td>855 men aged 50 at entry</td><td>Larsson, 1978</td></tr>
<tr><td></td><td>No effect of weight, controlling for serum cholesterol and blood pressure</td><td>No effect analyzing trends in rate of MI by initial weight (RAW) at different levels of serum cholesterol and blood pressure</td><td>12</td><td>Framingham Study, 5127 men and women aged 30-59 at entry</td><td>Kannel, LeBauer, Dawber, et al., 1967</td></tr>
<tr><td>Angina pectoris</td><td>Incidence increased as weight increased</td><td>Morbidity Ratio[b]
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(slope significant, $p < .05$)</td><td>12</td><td>Framingham Study, 5127 men and women aged 30-59 at entry</td><td>Kannel, LeBauer, Dawber, et al., 1967</td></tr>
<tr><td></td><td>Weight was higher in cases than in noncases</td><td>Using stepwise discriminant function analysis, weight (H/∛W) discriminated AP cases from normals (cases were heavier) in one subsample ($p < .05$)</td><td>13</td><td>Los Angeles Co. Heart Study, 382 men aged 40-49</td><td>Chapman, Coulson, Clark, et al., 1971</td></tr>
<tr><td></td><td></td><td>Mean weight higher in men with angina (RRWL-117) than in men with no coronary heart disease (RRWL=112) ($p < .05$)</td><td rowspan="2">2</td><td rowspan="2">Honolulu Heart Study, 8006 men aged 45-64 at entry</td><td rowspan="2">Kagan, Gordon, Rhoads, et al., 1975</td></tr>
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<tr><td>Sum of skinfolds</td><td>28.0</td><td>24.2</td><td>$p < .01$</td></tr>
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(significance not tested)</td><td>Unspecified (weight at most recent exam)</td><td>Framingham Study, 5209 people aged 45-74 at most recent exam</td><td>Kannel and Gordon, 1974</td></tr>
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</table>

Table 8—continued

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Angina pectoris (cont.)	Incidence was higher in overweight than in underweight people	Using bivariate regression, weight (RRWL) predicted cases for both men and women ($p < .05$)	Unspecified (weight at most recent exam)	Framingham Study, 5209 people aged 45-74 at most recent exam	Kannel and Gordon, 1974
	No effect	Age adjusted rate per 1000 for three categories of $H/\sqrt[3]{W}$ showed no trend	15	Los Angeles Heart Study, 1859 men aged 20-70 at entry	Chapman, Coulson, Clark, et al., 1971
	No effect	No difference in weight (W/H^2) between men with angina and men without ischemic heart disease No trend in morbidity ratio as a function of weight (W/H^2)	26	Manitoba Study, 3983 men aged 15-64 at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
	No effect	Using stepwise discriminant function analysis, weight ($H/\sqrt[3]{W}$) did not discriminate cases from noncases in three subsamples	15	Los Angeles Co. Heart Study, 354 men aged 30-39 389 men aged 50-59 160 men aged 60-70	Chapman, Coulson, Clark, et al., 1971
	No effect of weight controlling for age and blood pressure	Using multiple logistic function analysis, weight (W/H^2) did not predict cases	26	Manitoba Study, 3983 men aged 15-64 at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
Coronary artery disease	Weight was greater in cases than in noncases	Prevalence of overweight ($RRWL \geq 115$) was 71 percent in people with disease and 14 percent in people without ($p < .01$)	Cross-sectional	91 patients referred for cardiac evaluation, aged 31-50	Salel, Riggs, Mason, et al., 1974
	No effect	No significant difference in prevalence as a function of weight (RRWL)	Cross-sectional	176 patients referred for cardiac evaluation, aged 31-68	
	Mortality due to coronary artery disease was greater in overweight compared to normal-weight people	Overweight people ($RAW \geq 120$) had 35 percent excess mortality compared to men insured as standard risks (weight measured by mixture of self-report and examination)	1-19 (follow-up time was number of years insured)	People aged 15-69	Metropolitan Life Insurance Co., 1960

<table>
<tr><th>Manifestation of Heart Disease/Definition</th><th>Nature of Relationship</th><th>Method and Data Regarding Effect[a]</th><th>Years of Follow-Up</th><th>Population</th><th>Reference</th></tr>
<tr><td>Myocardial infarction or death from coronary heart disease</td><td>Incidence varied as a function of weight</td><td>Number of new cases in five years varied across weight quintiles for measures of W/H^2, RAW, and skinfold thickness (using χ^2, $p < .05$):
<table>
<tr><th>Quintile</th><th>W/H^2</th><th>RAW</th><th>Sum of Skinfolds</th></tr>
<tr><td>1 (lowest)</td><td>9</td><td>10</td><td>10</td></tr>
<tr><td>2</td><td>13</td><td>12</td><td>8</td></tr>
<tr><td>3</td><td>7</td><td>7</td><td>11</td></tr>
<tr><td>4</td><td>19</td><td>19</td><td>22</td></tr>
<tr><td>5 (highest)</td><td>22</td><td>22</td><td>19</td></tr>
</table></td><td>5</td><td>2439 Northern European men aged 40-59 at entry</td><td>Keys, Aravanis, Blackburn, et al., 1972</td></tr>
<tr><td></td><td>Incidence varied as a function of weight</td><td>Number of new cases in five years varied across weight quintiles for a measure of W/H^2 (using χ^2, $p < .01$):
<table>
<tr><th>Quintile</th><th>W/H^2</th></tr>
<tr><td>1 (lowest)</td><td>17</td></tr>
<tr><td>2</td><td>7</td></tr>
<tr><td>3</td><td>13</td></tr>
<tr><td>4</td><td>5</td></tr>
<tr><td>5 (highest)</td><td>22</td></tr>
</table></td><td>5</td><td>6518 Southern European men aged 40-59 at entry</td><td>Keys, Aravanis, Blackburn, et al., 1972</td></tr>
<tr><td></td><td>No effect of weight, controlling for age, systolic blood pressure, serum cholesterol, and smoking habits</td><td>Using a multiple logistic function analysis, weight (W/H^2, sum of skinfolds, RAW) did not predict incidence in three samples</td><td>5</td><td>2442 U.S. railroad men aged 40-59 at entry; 2439 Northern European men aged 40-59 at entry; 6518 Southern European men aged 40-59 at entry</td><td>Keys, Aravanis, Blackburn, et al., 1972</td></tr>
<tr><td></td><td>No effect</td><td>No effect in three samples using χ^2 to test for independence of cases vs. noncases and overweight vs. nonoverweight (W/H^2, RAW, and sum of skinfolds)</td><td>5</td><td>2442 U.S. railroad men aged 40-59 at entry; 2439 Northern European men aged 40-59 at entry; 6518 Southern European men aged 40-59 at entry</td><td>Keys, Aravanis, Blackburn, et al., 1972</td></tr>
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</table>

Table 8—continued

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Myocardial infarction or death from coronary heart disease (cont.)	No effect (men)	No effect using χ^2 to test independence of cases vs. noncases and weight (quintiles of RAW and sum of skinfolds)	5	6518 Southern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
	No effect in men controlling for age, blood pressure, serum cholesterol, smoking, and resting pulse rate	Using multiple logistic analysis, W/H^2 was not significant either linearly or quadratically	10	217 Northern European men aged 40-59 at entry; 162 Southern European men aged 40-59 at entry	Keys, 1980
Myocardial infarction or sudden death[c]	Incidence increased as weight increased (men)	$H/\sqrt[3]{W}$ [b] — Rate/1000 ≥13.0 (low) — 77 12.0 - 12.99 — 89 <12.0 (high) — 118 (significance not tested)	15	Los Angeles Co. Heart Study, 1859 men aged 20-70 at entry	Chapman, Coulson, Clark, et al., 1971
	Incidence increased as weight increased, controlling for age, systolic blood pressure, diastolic blood pressure, and serum cholesterol (men)	Using a stepwise discriminant function analysis, weight ($H/\sqrt[3]{W}$) discriminated cases from normals (cases were heavier) in one subsample ($p < .05$)	15	Los Angeles Co. Heart Study, 354 men aged 30-39 at entry	
	No effect of weight, controlling for age, blood pressure, and serum cholesterol (men)	Using a stepwise discriminant function analysis, weight ($H/\sqrt[3]{W}$) did not discriminate cases from noncases in three subsamples	15	Los Angeles Co. Heart Study, 382 men aged 40-49 389 men aged 50-59 160 men aged 60-70	
Angina pectoris or sudden death	Overweight people had greater incidence, controlling for blood pressure and serum cholesterol	Analysis of morbidity ratios by weight at different levels of serum cholesterol and blood pressure revealed that overweight people (RAW ≥120) had excess incidence compared to normal weight people (RAW ≤120) Level of Blood Pressure and Serum Cholesterol — Morbidity Ratio[g]: RAW <120 — RAW ≥120 Men: Neither elevated — 70 — 190 Men: One or both elevated — 115 — 324 Women: Neither elevated — 65 — 72 Women: One or both elevated — 113 — 176 (significance not tested)	12	Framingham Study, men aged 30-59 at entry	Kannel, LeBaue, Dawber, et al., 1967

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Angina pectoris or myocardial infarction	As weight increased, prevalence increased	RBWL — Prevalence (percent) Below normal[b] — 4.5 Normal — 7.8 ≥120 — 9.2 (significance not tested)	Cross-sectional	5000 Jewish men aged 35-65 at entry	Spain, Nathan, and Gellis, 1963
	Prevalence was higher in overweight men, controlling for blood pressure	Mean relative prevalence[i] was significantly different ($p < .05$) for overweight (relative weight[j] in upper quintile) compared to those not overweight (lower four quintiles)	Cross-sectional	Tecumseh Michigan Study, 2449 men aged 16 and older	Epstein, Ostrander, Johnson, et al., 1965
	No effect in women, controlling for blood pressure	Mean relative prevalence[i] was not significantly different for overweight (relative weight[j] in upper quintile) compared to those not overweight (lower four quintiles)	Cross-sectional	Tecumseh Michigan Study, 2680 women aged 16 and older	
	No effect	No effect comparing incidence across four categories of weight (ponderal index (formula not specified)	4.5	Western Collaborative Group Study, 3524 men aged 39-59 at entry	Rosenman, Friedman, Straus, et al., 1970
Angina pectoris or clinical judgment of heart disease caused by myocardial infarction (based on ECG, history, and clinical evidence)	Incidence varied as a function of weight	Number of new cases in five years varied across weight quintiles for measures of W/H^2, RAW, and skinfold thickness (using χ^2, $p < .05$) Quintile — W/H^2 — RAW — Skinfold 1 (lowest) — 18 — 16 — 15 2 — 20 — 19 — 29 3 — 27 — 27 — 19 4 — 29 — 30 — 32 5 (highest) — 39 — 40 — 38	5	2442 U.S. railroad men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
	Incidence varied as a function of weight	Number of new cases in five years varied across weight quintiles for measures of RAW and skinfold thickness (using χ^2, $p < .05$) Quintile — RAW — Skinfold 1 (lowest) — 16 — 17 2 — 21 — 28 3 — 28 — 25 4 — 35 — 29 5 (highest) — 42 — 46	5	6518 Southern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972

Table 8—continued

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Angina pectoris or clinical judgment of heart disease caused by myocardial infarction (based on ECG, history, and clinical evidence) (cont.)	No effect	No effect using χ^2 to test for independence of cases vs. noncases and weight (quintiles of W/H^2)	5	6518 Southern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
	No effect	No effect using χ^2 to test for independence of cases vs. noncases and weight quintiles (W/H^2, RAW, sum of skinfolds)	5	2439 Northern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
	No effect of weight, controlling for age, systolic blood pressure, serum cholesterol, and smoking habits	Using a multiple logistic function analysis, no effect of weight (W/H^2, sum of skinfolds, RAW) in three samples	5	2442 U.S. railroad men aged 40-59 at entry; 2439 Northern European men aged 40-59 at entry; 6518 Southern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
Angina pectoris, myocardial infarction, sudden death, or coronary insufficiency	Weight higher in cases than in noncases	Mean Weight or Skinfold Thickness Measure — Cases — Noncases — Significance RRWL — 118 — 112 — < .01 Triceps skinfold — 9.2 — 7.9 — < .01 Scapular skinfold — 19.4 — 16.2 — < .01 Sum of skinfolds — 28.6 — 24.2 — < .01	2	Honolulu Heart Study, 8006 Japanese men aged 45-64 at entry	Kagan, Gordon, Rhoads, et al., 1975
	Incidence increased as weight increased	RRWL — Rate/1000/Year < 110 — 2.4 110 - 119 — 6.2 120 - 129 — 7.2 ≥130 — 8.5			
	Incidence increased as weight increased, controlling for serum cholesterol, systolic blood pressure, smoking, glucose intolerance, serum triglyceride, serum uric acid	Using a logistic regression analysis, weight (sum of skinfolds) remained significant ($p < .01$)			

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Angina pectoris, myocardial infarction, sudden death, or coronary insufficiency (cont.)	Incidence increased as weight increased, controlling for age and blood pressure	Using a multiple logistic function analysis, weight (W/H^2) remained significant ($p < .01$)	26	Manitoba Study, 3983 men aged 15-64 at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
Angina pectoris, myocardial infarction, or death from coronary disease	Fatness higher in cases than in noncases	Mean Skinfold Thickness (cm) Skinfold | Cases | Noncases | Significance Triceps | 1.52 | 1.39 | ($p < .05$) Subscapular | 1.98 | 1.81 | ($p < .01$)	4.5	5397 men aged 40-55 at entry	Paul, Lepper, Phelan, et al., 1963
Angina pectoris, myocardial infarction, sudden death, or coronary insufficiency	Weight higher in cases than noncases	Mean weight (W/H^2) was 2.47 for cases and 2.36 for noncases ($p < .01$)	26	Manitoba Study, 3983 men aged 15-64 at entry[f] (mean age 30.8)	Rabkin, Mathewson, and Hsu, 1977
	Incidence increased directly as weight increased	W/H^2[g] | Morbidity Ratio < 22.5 | 66 22.6 - 25.0 | 107 25.1 - 27.5 | 121 ≥ 27.6 | 128 (significance not tested)			
	Incidence higher in overweight people	Incidence/10,000 RRWL | Men | Women 65 - 99 | 111 | 53 140 - 272 | 186 | 81 (significance not tested) Using bivariate regression analysis, weight (RRWL) predicted incidence for both men and women ($p < .01$)	10	Framingham Study, 5209 people aged 30-59 at entry	Kannel and Gordon, 1974
Angina pectoris, myocardial infarction, death from coronary disease, or clinical judgment of definite heart disease caused by myocardial infarction (based on ECG, history, and clinical evidence)	Incidence increased as weight increased	Significant χ^2 testing cases vs. noncases by overweight vs. nonoverweight using W/H^2 ($p < .001$), RAW ($p < .001$), and sum of skinfolds ($p < .01$) Significant χ^2 testing cases vs. noncases by quintiles of weight using W/H^2 ($p < .01$), RAW ($p < .01$), and sum of skinfolds, ($p < .01$)	5	6518 Southern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972

Table 8—continued

Manifestation of Heart Disease/Definition	Nature of Relationship	Method and Data Regarding Effect[a]	Years of Follow-Up	Population	Reference
Angina pectoris, myocardial infarction, death from coronary disease, or clinical judgment of definite heart disease caused by myocardial infarction (based on ECG, history, and clinical evidence) (cont.)	Incidence increased as weight increased	Significant χ^2 testing cases vs. noncases by quintiles of weight using RAW ($p < .05$) and sum of skinfolds ($p < .05$)	5	2442 U.S. railroad men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
		Significant χ^2 testing cases vs. noncases by overweight vs. nonoverweight using W/H^2 ($p < .05$), sum of skinfolds ($p < .01$), and RAW ($p < .05$)			
	No effect	No effect using χ^2 to test cases vs. noncases by overweight vs. nonoverweight, using W/H^2, RAW, or sum of skinfolds	5	2439 Northern European men aged 40-59 at entry	Keys, Aravanis, Blackburn, et al., 1972
		No effect using χ^2 to test cases vs. noncases by quintiles of weight, using W/H^2, RAW, and sum of skinfolds			

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[a] Data on weight and fatness were obtained by examination unless otherwise specified.

The following abbreviations are used in this column:

RAW = relative average weight,
RRWL = relative recommended weight (life insurance recommended),
W/H^2 = weight (kg) divided by height (m) squared,
MI = myocardial infarction,
AP = angina pectoris.

[b] $H/\sqrt[3]{W}$ decreases as weight increases.

[c] Natural death occurring within 24 hours after onset of ischemic heart disease symptoms (Rabkin, Mathewson, and Hsu, 1977).

[d] We transformed these W/H^2 data to kg/m^2; the original data were reported as g/cm^2.

[e] Ratio of observed cases to expected cases multiplied by 100.

[f] Ninety percent of these men were under age 40; this is a sample of licensed pilots.

[g] Ratio of observed cases to expected cases for people in that weight category, multiplied by 100. Expected cases were calculated in terms of age-specific incidence rates.

[h] Below minimum recommended weight for a given body-frame type using life insurance tables.

[i] Essentially the ratio of prevalence from upper range to lower range weight groups (see appendix in Epstein, Ostrander, Johnson, et al., 1965, for details).

[j] Relative weight = "ratio of actual weight on height, biacromial diameter, and bicristal diameter; these regressions were obtained separately for men and women aged 20 to 29 years in the Tecumseh population" (Epstein, Ostrander, Johnson, et al., 1965, p. 1179).

tions of heart disease has been studied as a separate dependent variable as well as in various combinations. Both univariate and multivariate analyses have been performed. In the latter type of analyses, the relationship between weight (and obesity) and heart disease are adjusted for differences in other important predictors of heart disease such as blood pressure. Whenever other variables are controlled for in multivariate analyses, we specify these variables in Table 8 in the column labeled "Nature of Relationship." Overweight and obesity were assessed in several ways. We organized the 16 studies represented in the table by the manifestation of heart disease investigated, beginning with the separate manifestations and ending with the studies that investigated heart disease in its most aggregated form.

In attempting to summarize the data in Table 8, several difficulties arise. One cannot simply "count" the instances of effects versus no effects for three reasons. First, in some cases, a trend or difference was not tested for significance. Second, if a particular investigator used more than one measure of overweight and/or used more than one method of analysis, data from that one population appear repeatedly in the table, which gives the illusion of a preponderance of that type of result. Third, researchers sometimes detected a significant effect using one measure or method of analysis but no effect using another.

Mortality Due to Coronary Heart Disease. The findings are varied regarding the relationship between weight and mortality due to coronary heart disease. Two studies should be given the most consideration because multivariate analyses were performed controlling for age, blood pressure, serum cholesterol, and cigarette smoking, and because quadratic trends were tested (Dyer, Stamler, Berkson, et al., 1975; Keys, 1980). One of these two studies found that increased mortality was associated with both underweight and overweight (measured as W/H^2) (Dyer, Stamler, Berkson, et al., 1975). However, this same study failed to observe this effect when RRWL was used as an indicator of weight. The other study (Keys, 1980) found no association between W/H^2 and mortality in three samples of men (these three sample sizes were less than 100 each). The curvilinear trend found by Dyer, Stamler, Berkson, et al., 1975, was also observed in the American Cancer Society Study. The remaining findings varied; that is, a relationship was sometimes observed and sometimes not.

Sudden Death. The incidence of sudden death was directly related to weight (measured by W/H^2) in one study with a 26-year follow-up, after controlling for age and blood pressure (Rabkin, Mathewson, and Hsu, 1977); however, serum cholesterol and smoking were not controlled. In another study, overweight and underweight men were more likely to experience sudden death than men of average weight (with severely overweight men at greater risk than underweight men) (Kannel, Lebauer, Dawber, et al., 1967; Kannel and Gordon, 1974). In the latter study, no relationship was found between sudden death and weight in women.

Myocardial Infarction. Weight was not related to the incidence of myocardial infarction in three of four studies. In one study with a 26-year follow-up, weight (W/H^2) was directly related to myocardial infarction and remained significant after controlling for age and blood pressure. In the three studies in which no effect was found, the follow-up periods were all less than 16 years.

Angina Pectoris. Weight was positively associated with the development of angina pectoris in three study populations, mixed effects were observed in a fourth population, and no effects were observed in a fifth population. The mixed effects occurred in a study with just less than 16 years of follow-up; the sample in which no effects were observed consisted of pilots, and age and blood pressure were controlled.

Coronary Artery Disease. Weight was positively associated with coronary artery disease in two populations. In one of these (Salel, Riggs, Mason, et al., 1974), when people over age 50 were included in the analysis, the effect disappeared; these were cross-sectional data, however. No multivariate analyses were performed.

Multiple Outcome Measures. Significant effects of weight on heart disease using multiple indicators (e.g., angina pectoris *or* myocardial infarction) were found in many studies using a variety of measures of weight and a variety of statistical tests. In all instances in which no effect was observed, the follow-up period was five years or less.

Summary of Table 8. A visual inspection of Table 8 gives the impression that the relationship between weight and coronary heart disease is not consistently positive (i.e., heart disease is not a function of weight in all studies). The inconsistencies in the data could be explained as follows: (1) There is a true adverse effect of overweight on coronary heart disease for all people, but some studies have been unable to detect it because of methods problems; or (2) the data reflect the true state in which there is a relationship between overweight and coronary heart disease for some people (e.g., those with high blood pressure or serum cholesterol).

If the first explanation is correct, we must account for the inconsistencies by finding methodologic differences among the studies that found a relationship between weight and heart disease and those that did not. We have attempted to do this. First, as noted previously, in studies employing several measures of weight (see Table 5), measures of weight correlated differently with health outcomes; relative weight measures may have slightly lower correlations with health outcomes than W/H^2 or skinfold thickness. Second, if there is a curvilinear association between weight (and fatness) and heart disease, studies that test for only linear associations (e.g., a comparison of overweight to underweight people, or a test of an increasing positive relationship) may conclude that there is no relationship between weight and heart disease. Third, it may be essential to control for blood pressure, serum cholesterol, and cigarette smoking to determine the true relationship. Fourth, the length of the follow-up period may affect the correlation with the health outcome. In one study, W/H^2 correlated with an increased occurrence of ischemic heart disease only after 16 years of follow-up; the relationship between overweight and coronary heart disease increased in magnitude as the years of follow-up increased from 16 to 22 (Rabkin, Mathewson, and Hsu, 1977). Finally, there is evidence (see Table 8) that the relationship between overweight (and obesity) and heart disease is primarily seen in people who are younger (i.e., those less than 40 or 50) at the time of entry into a study (Rabkin, Mathewson, and Hsu, 1977; Chapman, Coulson, Clark, et al., 1971; James, 1976).[1]

In interpreting and comparing the results in Table 8, we find that these facts provide a plausible explanation for many of the instances in which no relationship between weight and coronary heart disease was observed. Nevertheless, when we examine this table and compare its contents with data on the adverse effects of smoking status on coronary heart disease (see Stewart, Brook, and Kane, 1979), we observe that the influence of weight on heart disease is much harder to detect than the influence of cigarette smoking; that is, it is not present as uniformly across all populations and is much less important.

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[1] This could, however, be confounded with years of follow-up because younger-aged cohorts are more likely to have been followed for more years.

Diabetes

A summary of the relationship between overweight and the prevalence and incidence of mortality from diabetes is shown in Table 9. Six tests of the association between weight and diabetes were available in four study populations. A sizable adverse relationship between overweight and both mortality due to diabetes and the incidence of diabetes was observed in all populations. Especially worthy of

Table 9

RELATIONSHIP BETWEEN OVERWEIGHT AND DIABETES

Relationship	Method and Data[a]	Years of Follow-Up	Population	Reference
Mortality due to diabetes increases as weight increases	Mortality Ratio Initial RAW — Men — Women <80 — .88 — .65 80 - 89 — .84 — .61 90 - 109 — 1.00 — 1.00 110 - 119 — 1.65 — 1.92 120 - 129 — 2.56 — 3.34 130 - 139 — 3.51 — 3.78 140+ — 5.19 — 7.90	13	American Cancer Society Study, 750,000 people aged 30 and older at entry	Lew and Garfinkel, 1979
Overweight people have large excess mortality due to diabetes	Excess mortality (percent) due to diabetes for overweight (RAW≥120) compared to persons insured as standard risks: Men 133 Women 83	1-19 (follow-up time was number of years insured)	Insured people aged 15-69	Metropolitan Life Insurance Company, 1960
Diabetics are more overweight than nondiabetics	Percent Overweight (RAW ≥ 110) — Men — Women Diabetic — 70 — 55 Nondiabetic — 36 — 43 (significance not tested)	Cross-sectional	238 diabetics aged 45-65 compared to matched controls	Baird, 1973
	Percent Overweight (RAW≥120) at Entry — Men — Women Diabetic — 20 — 42 Nondiabetic — 10 — 19 (significance not tested)	16	Framingham Study, 5209 people aged 30-59	Garcia, McNamara, Gordon, et al., 1974
	Mean RAW — Men — Women Diabetic — 126 — 129 Nondiabetic — 122 — 121 (p < .05) (p < .001)	Cross-sectional	Framingham Study, 2815 people aged 49-82	Gordon, Castelli, Hjortland, et al., 1977
Incidence of diabetes increased as weight increased	Initial RAW — Incidence Ratio[b] <90 — 78 90 - 99 — 65 100 - 109 — 92 110 - 119 — 120 120 - 129 — 115 130 - 139 — 265 (significance not tested)	10	Framingham Study, 5209 people aged 30-62 at entry	Kannel, Pearson, and McNamara, 1969

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[a] RAW = relative average weight.

[b] Ratio of observed cases to expected cases for people in that weight category, multiplied by 100. Expected cases were calculated in terms of incidence ratio for seven age groups.

attention is the large increase in the incidence of diabetes and mortality due to diabetes for people whose weight is 30 to 40 percent or more above average (Kannel, Pearson, and McNamara, 1969; Lew and Garfinkel, 1979).

Blood Pressure and Serum Cholesterol

Table 10 summarizes the relationship between weight and both blood pressure and serum cholesterol. The evidence strongly suggests that both blood pressure and serum cholesterol increase as weight increases. All correlation coefficients that were statistically tested were significant, although it should be noted that these relationships were often very slight; thus, only a small proportion of the variance in blood pressure and serum cholesterol was accounted for by weight.

BENEFICIAL EFFECTS OF REDUCTION IN WEIGHT AND FATNESS ON HEALTH

Very few studies have been conducted on the beneficial effects of a reduction in weight or fatness on health status. This may be because it has been found that weight loss is difficult to sustain, or that weight loss is often accompanied by other changes, such as starting to exercise, making it hard to distinguish the effect of changes in weight from changes in other health habits. Table 11 gives a summary of three studies of the effects of weight loss on overall premature mortality and blood pressure. In all tests of the effects of weight loss, beneficial effects were observed; however, in two studies, the follow-up period was less than a year and in the third, it was not specified.

Because of the paucity of studies specifically addressing this issue, we had to rely on the data already presented (i.e., on the effects of specified levels of weight on health) to justify its use as a health habit measure in the HIS. These data suggest that being overweight does have some effect on many different health outcomes, but that the effects may not manifest themselves for long periods of time and appear to be less consistent than those predicted by other health habits such as smoking.

SUMMARY

Although the evidence tends to support the conclusion that there is a relationship between overweight (and obesity) and health, it is somewhat equivocal.[a] The relationship depends on the population studied, the measure used, the length of the follow-up period, the outcome that is evaluated, and the method of analysis. For some specific outcomes, the relationship is clear: Overweight is positively related to the prevalence of diabetes. For all manifestations of heart disease, an association between overweight (and obesity) and heart disease is sometimes found and some-

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[a] In a recently released report on obesity in America (Bray, 1979), the author concludes after reviewing similar evidence to that reported here that obesity is a *major* health problem in America. We believe that the present evidence warrants a more conservative evaluation of the effect of weight on health but will keep abreast of the literature on this issue during the course of the HIS to see if a more definitive conclusion can be reached.

Table 10

RELATIONSHIP OF OVERWEIGHT AND OBESITY TO BLOOD PRESSURE AND SERUM CHOLESTEROL

Health Outcome	Effect	Method and Data[a]	Years of Follow-Up	Population	Reference
Blood pressure	As weight increased, blood pressure increased	Product-moment correlations between weight (W/H^2) and blood pressure: 1. At six different points in time (cross-sectional data): SBP - range from .13 to .16 (median .15) DBP - range from .15 to .22 (median .19) (all significant, $p < .01$) 2. Weight at one time, blood pressure five years later: SBP - range from .14 to .19 (median .16 of 5 coefficients) DBP - range from .16 to .20 (median .16 of 5 coefficients) (all significant, $p < .01$)	27	Manitoba Follow-Up Study, 3054 men (mean age 31 at entry)	Hsu, Mathewson, and Rabkin, 1977
	As weight increased, blood pressure increased	Product-moment correlations between weight (RRWL) and blood pressure for eight age-sex-race groups: SBP - range from .24 to .37 (median .28) DBP - range from .24 to .32 (median .28) (all significant, $p < .001$)	Cross-sectional	Chicago Heart Association Detection Project in Industry, 1967-1972, 21,024 people aged 25-64 at entry	Stamler, Rhomberg, Schoenberger, et al., 1975
	As weight increased, blood pressure increased	Product-moment correlations between weight and SDP in two samples: Sample — W/H^2 — RAW — Sum of Skinfolds 1 — .24 — .21 — .20 2 — .23 — .20 — .17 (all significant, $p < .01$)	Cross-sectional	2062 U.S. railroad men and 8308 European men aged 40-59 years	Keys, Aravanis, Blackburn, et al., 1972
	As weight increased, blood pressure increased	Product-moment correlations between weight (RRW) and blood pressure: — Men — Women SBP — .24 — .30 DBP — .33 — .33 (significance not tested)	Cross-sectional (second exam)	Framingham Study, 5209 people aged 30-59 at entry	Gordon and Kannel, 1973

Table 10—continued

Health Outcome	Effect	Method and Data[a]	Years of Follow-Up	Population	Reference
Blood pressure (cont.)	As weight increased, blood pressure increased	Conclusion from a review of 31 studies: 1. Most populations show increased blood pressure with increased weight 2. The association between blood pressure and weight is greater in women than in men 3. SBP shows a greater association with weight than DBP	N/A[b]	N/A	Chiang, Perlman, and Epstein, 1969
	Weight remained a significant predictor of blood pressure, controlling for age, heart rate, hematocrit, serum cholesterol, plasma glucose one hour after 100 g oral glucose load	Using partial correlation, multiple logistic regression, multiple linear regression, weight (RRWL) remained significant: 1. Partial correlations in eight age-sex-race groups: SBP - range from .22 to .32 (median .27) DBP - range from .22 to .36 (median .30) (all significant, $p < .001$) 2. Multiple logistic regression: 31 of 32 t-values for RRWL were significant ($p < .01$) 3. Multiple linear regression: 16 of 16 F-values for RRWL were significant ($p < .001$)	Cross-sectional	Chicago Community Surveys, 1965-1971, 13,469 people aged 30-64	Stamler, Stamler, Rhomberg, et al., 1975
Serum cholesterol	As weight increased, serum cholesterol increased	Product-moment correlations between weight and serum cholesterol in two samples: Sample — W/H^2 — RAW — Sum of Skinfolds 1 — .08 — .10 — [illegible] 2 — .16 — .13 — [illegible] (significance not tested)	Cross-sectional	2062 U.S. railroad men; 8308 European men aged 14-59 years	Keys, Aravanis, Blackburn, et al., 1972
	As weight increased, serum cholesterol increased	Product-moment correlations between weight and serum cholesterol for men, $r = .15$; for women, $r = .07$ (significance not tested)	Cross-sectional	Framingham Study, 5209 people aged 30 to 59 at entry	Gordon and Kannel, 1973

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[a] The following abbreviations are used in this column:
RAW = relative average weight,
RRW = relative recommended weight,
RRWL = relative recommended weight--life insurance recommended,
W/H^2 = weight (kg) divided by height (m) squared.

[b] Not applicable.

Table 11

SUMMARY OF THE EFFECTS OF WEIGHT LOSS ON HEALTH STATUS

<table>
<tr><th>Health Variable</th><th>Nature of Effect</th><th>Method and Data Regarding Effect</th><th>Population</th><th>Reference</th></tr>
<tr><td>Overall mortality</td><td>Overall mortality was lower for overweight people who reduced than for those who did not</td><td>Mortality ratios:[a]
<table>
<tr><th></th><th colspan="2">Lower Extra-Premium Group[b]</th><th colspan="2">Higher Extra Premium Group[b]</th></tr>
<tr><th></th><th>Men</th><th>Women</th><th>Men</th><th>Women</th></tr>
<tr><td>Reduced</td><td>113</td><td>90</td><td>109</td><td>135</td></tr>
<tr><td>Total Sample</td><td>142</td><td>142</td><td>179</td><td>161</td></tr>
</table>
</td><td>People who were limited to substandard (extra premium) insurance because of overweight</td><td>Dublin, 1953 (evaluation of Metropolitan Life Insurance data)</td></tr>
<tr><td>Blood pressure</td><td>Blood pressure (both systolic and diastolic) was significantly reduced in both hypertensive and normotensive obese people who lost weight compared with obese people who did not lose weight over a four-month period</td><td>
<table>
<tr><th></th><th></th><th colspan="2">Mean Change (mm Hg) in Blood Pressure</th><th colspan="2">Product-Moment Correlation between Weight Loss and Blood Pressure</th></tr>
<tr><th>Group</th><th>Mean Weight Loss in Pounds</th><th>Diastolic</th><th>Systolic</th><th>Diastolic</th><th>Systolic</th></tr>
<tr><td>A - Hypertensives who lost weight</td><td>32
(17%)[c]</td><td>-16
(15%)</td><td>-33
(17%)</td><td rowspan="2">.54
(p < .001)</td><td rowspan="2">.58
(p < .001)</td></tr>
<tr><td>B - Normotensives who lost weight</td><td>30
(16%)</td><td>-4
(4%)</td><td>-11
(8%)</td></tr>
<tr><td>C - Hypertensives who did not lose weight</td><td>4
(2%)</td><td>+1
(1%)</td><td>+1
(1%)</td><td></td><td></td></tr>
</table>
Differences in blood pressure were tested between groups:
<table>
<tr><th>Groups</th><th>Diastolic</th><th>Systolic</th></tr>
<tr><td>A vs. B</td><td>p < .001</td><td>p < .001</td></tr>
<tr><td>A vs. C</td><td>p < .001</td><td>p < .001</td></tr>
<tr><td>B vs. C</td><td>p < .01</td><td>p < .001</td></tr>
</table>
</td><td>165 women with initial RBWL ≥ 120 (6-8 month study)</td><td>Fletcher, 1954</td></tr>
<tr><td></td><td>Weight loss without salt restriction over a six-month period directly associated with lowering of blood pressure in obese people</td><td>
<table>
<tr><th></th><th></th><th colspan="2">Mean Change (mm Hg) in Blood Pressure</th><th colspan="2">Product-Moment Correlation between Weight Change and Blood Pressure Change</th></tr>
<tr><th>Group</th><th>Mean Weight Change</th><th>Diastolic</th><th>Systolic</th><th>Diastolic</th><th>Systolic</th></tr>
<tr><td>People who lost weight and received no antihypertensive drugs (N=24)</td><td>-14</td><td>-20</td><td>-26</td><td>.56
(p < .05)</td><td>.42
(p < .001)</td></tr>
<tr><td>People who lost weight and received antihypertensive drugs (N=57)</td><td>-15</td><td>-23</td><td>-37</td><td>.30
(p < .001)</td><td>.24
(p < .05)</td></tr>
<tr><td>People who did not lose weight and received antihypertensive drugs (N=26)</td><td>-1</td><td>-2</td><td>-7</td><td>N.S.[d]</td><td>N.S.</td></tr>
</table>
</td><td>107 overweight patients with uncomplicated essential hypertension (six-month study)</td><td>Reisin, Abel, Modan, et al., 1978</td></tr>
</table>

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[a] In relation to people insured as standard risks.

[b] The distinction between the "lower" and "higher" extra premium groups is not clear in the Dublin article. The implication is that the lower group was charged a lower extra premium because they were less overweight.

[c] Percent of initial value.

[d] Not significant.

times not. For the outcome of overall premature mortality, extremely overweight people consistently experience higher premature mortality than normal weight people; underweight people (especially men) sometimes experience higher mortality than normal weight people.

It is also not clear from the data what the nature of the relationship is between health and weight. For some outcomes (e.g., prevalence of hypertension or angina pectoris), the trend is negative and linear (i.e., as weight increases, health becomes poorer). For others such as diabetes, a dramatic increase in morbidity is observed as weight increases beyond a certain point. For yet others such as coronary heart disease, both underweight and severely overweight people seem to be at higher risk.

V. CONSTRUCTION OF MEASURES OF WEIGHT AND OVERWEIGHT IN THE HEALTH INSURANCE STUDY

SAMPLE INFORMATION AND DATA-GATHERING PROCEDURES

Sample Information

The data presented in this report were obtained from 2956[1] families enrolled in the HIS who lived in six sites in four areas of the United States: Dayton, Ohio; Seattle, Washington; Fitchburg and Franklin County, Massachusetts; and Charleston and Georgetown County, South Carolina. The families enrolled represent 82 percent of the families who were offered enrollment. The families who accepted enrollment were representative of the population offered enrollment in Dayton;[2] such an analysis has not yet been conducted in the other sites. The families who were offered enrollment differed intentionally from their respective populations in that eligibility was restricted to families with a head of household aged 61 or under and with an annual family income of $25,000 or less (in 1973 dollars). In Dayton, low-income families ($9,000 or less in 1973 dollars) were slightly oversampled, and those with incomes from $9,001 to $14,999 were slightly undersampled. In Seattle, sampling according to income was proportional to the income distribution of Seattle. In Massachusetts and South Carolina, families with incomes less than or equal to 1.5 times the poverty level had a four to three greater chance of being sampled. The sample enrolled in Seattle included a Group Health control group. Excluded from the entire HIS sample were people in institutions, members of the military, people who were receiving care for service-connected disabilities in Veterans Administration hospitals, and people eligible for Medicare and Supplemental Security Income (SSI).

We restricted the analyses described in this report to data on 5815 enrollees aged 14 to 61[3] from all six sites. Table 12 presents a summary of the characteristics of each of these six enrolled samples.

Data Gathering

Data on height and weight were gathered by two methods: a self-administered medical history questionnaire (MHQ) and a medical screening examination (MSE). Data on overweight and its effects were obtained by a self-administered questionnaire.

The MHQ was administered twice for each participant, at enrollment and again on leaving the HIS (after three years for some participants and after five years for others). The MSE was given to a randomly selected group of from 50 to 77 percent

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[1] This number includes 202 control group families in Dayton who were later dropped from the experiment.

[2] Carl Morris, unpublished Rand research.

[3] People over 61 in eligible families were enrolled but are not themselves eligible for insurance benefits. Although data are collected on these people, they represent a very small proportion of the sample (0.5 percent) and will not be included in the experimental analyses.

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Table 12

SUMMARY OF SOCIODEMOGRAPHIC AND DATA COLLECTION INFORMATION FOR SIX HEALTH INSURANCE STUDY SAMPLES OF PEOPLE AGED 14 TO 61

		Sex[a]		Race[a]	Age[b]		Number of School Years Completed		Family Income[c]			Time Period of Collection of Weight Data[d]
Sample	N	Percent Male	Percent Female	Percent Nonwhite	Range	Mean	Range	Mean	Range	Mean	Year for Which Reported	
Dayton	1212	48	52	13	14-61	34.3	2-24	12.6	0-27,000	13,687	1973	10/74-1/75
Seattle	2235	47	53	6	14-61	31.8	2-25	12.9	0-27,000	13,251	1974	11/75-9/76
Fitchburg	483	46	54	3	14-60	32.0	2-20	11.6	0-23,800	12,052	1974	5/75-10/76
Franklin County	585	46	54	<1	14-61	32.9	6-22	13.0	0-27,400	12,351	1974	5/75-10/76
Charleston	634	43	57	41	14-59	30.8	3-24	11.5	0-28,000	10,699	1975	9/76-2/77
Georgetown County	666	46	54	48	14-59	31.2	0-27	11.0	400-30,000	11,357	1975	9/76-2/77
All samples combined	5815	46	54	15	14-61	32.3	0-27	12.4	0-30,000	12,657	1973-1975	10/74-2/77

[a] Missing values did not enter the numerator or denominator in calculating percentages.

[b] A very small number of people over 61 in eligible families were enrolled but are not themselves eligible for insurance benefits. Although data are collected on these people, they will not be included in the experimental analyses.

[c] Income from the year reported here was used as a basis for determining eligibility (i.e., annual family income of $25,000 or less in 1973 dollars) except in Dayton; in Dayton, a weighted average of 1972 and 1973 income was used.

[d] Dates of administration of Enrollment Medical History Questionnaire.

of the participants at enrollment[4] and to all participants on leaving the HIS. Table 13 summarizes the characteristics of this MSE sample. A random sample (about 3 percent of those who took the MSE) was selected to receive repeat measures of height and weight, for purposes of estimating the reliability of the measurement techniques.

Table 13

SUMMARY OF SAMPLE CHARACTERISTICS FOR PEOPLE AGED 14 TO 61 WHO RECEIVED THE MEDICAL SCREENING EXAMINATION

		Age		Sex	
Site	N	Mean	Range	Percent Male	Percent Female
Dayton	626	34.6	14-61	47	53
Seattle	1044	32.9	14-61	46	54
Fitchburg	359	31.7	14-61	48	52
Franklin County	452	33.8	14-61	46	54
Charleston	424	31.4	14-61	44	56
Georgetown County	468	31.8	14-59	44	56
All sites combined	3373	32.9	14-61	46	54

The time lapse between completing the MHQ and taking the MSE was one month or less for 95 percent of the people; the maximum time difference was about three months; only 1 percent had time differences greater than two months.

The data on weight and overweight we report here are enrollment data derived from both the MHQ and the MSE.

Differences in data-gathering methods are likely to affect estimates of central tendency, reliability, and validity. Table 14 presents a summary list of factors that may influence survey results, along with a brief description of how each was handled for the weight items in the HIS. These methodological details should be kept in mind when interpreting HIS results. Discussions of these and other factors as they affect survey results are presented in Sudman and Bradburn (1974) and U.S. Department of Health, Education, and Welfare (1975b).

ITEMS USED TO MEASURE WEIGHT AND OVERWEIGHT

Items were included in the HIS to measure weight, height, and maximum ever weighed for all people; if a person reported being overweight, additional items were asked that assessed that person's efforts to reduce and the effects of being overweight in terms of restricted activity, worry, and pain. No measure of body fatness (e.g., skinfold thickness) was included in the HIS.

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[4] This random sample of participants will be compared later with those who did not receive the MSE to study the effect of undergoing the examination on the subsequent use of medical services and on health status at exit from the study.

Table 14

SUMMARY OF METHODOLOGICAL FACTORS THAT INFLUENCE SURVEY RESULTS AND CHARACTERISTICS OF HEALTH INSURANCE STUDY DATA-GATHERING METHODS RELEVANT TO THE WEIGHT BATTERY

Factors	Enrollment Medical History Questionnaire, Form A, Adults Aged 14 to 61
Context or purpose of data collection (e.g., voluntary household survey or evaluation of medical facility persons use)	Required of respondents enrolled in the study
Method of administration	Self-administered questionnaires are personally delivered by interviewer and returned by mail using a separate envelope for each person over 14
Instructions	None; examples of how to fill out the questionnaires are provided in the questionnaire
Location of interview	Respondent's home
Respondent interest in the subject	Probably high because of the focus on health status, health habits, and health care delivery
Sensitivity of questions	Somewhat sensitive because of the social stigma on being overweight, but self-administered nature of questionnaire should reduce this somewhat
Compensation	Dayton: $2 per person Other sites: $5 per person
Position of the questions/length of questionnaire	Dayton: Question numbers 1, 42-51 of 229 Other sites: Question numbers 1, 2, 26-27 of 130
Form of questions	Structured response choices
Recall period	Lifetime
Procedures to aid recall (e.g., use of diaries, memory aids, time bounding)	None
Instrument complexity	Not complex
Use of proxy respondents	None
Interview characteristics (similarity of interviewer and respondent characteristics, age, sex)	Self-administered
Field edit specifications	Careful editing for missing items; interviewer called back when the main screening item was missing in the weight battery or when more than six items were missing in the entire questionnaire
Data preparation methods	Standardized coding procedures; data are cleaned by a computer program that checks for possible coding errors and assigns a data status indicator describing the quality of data for each item in the questionnaire

Weight and height were measured in two ways: (1) by response to the self-administered MHQ, and (2) by technicians at the MSE. The items that assessed the effects of being overweight and efforts to reduce were included in the self-administered MHQ.

Medical History Questionnaire Items

Two versions of the MHQ items were administered in the HIS. The first was included in the Dayton Enrollment MHQ. After the distribution of item responses was evaluated in this questionnaire, a revised version was developed for the second (exit) administration in Dayton and for both administrations in other sites (enrollment and exit).

Table 15 lists the MHQ items used to measure weight, height, and overweight. It gives both versions of the questionnaire: the original, 11 items, and the revised, 12 items. Both versions included one skip pattern; respondents answered all of the questions pertaining to overweight only if they either believed they were overweight or had been told by a doctor or nurse that they were overweight (see items 44 and 27).

Three questions were included in the revised version of the MHQ to assess the effects of overweight (only two were included in version one). People who reported being overweight were asked to indicate the amount of worry, restricted activity, and pain caused by being overweight. These questions are part of a standard set of questions that appear repeatedly in the MHQ in association with various diseases and conditions. They are not specifically directed at measuring the effect of overweight. The item on pain is probably the least appropriate as an effect of being overweight. This could, however, refer to psychological pain or physical discomfort such as backache or leg pain caused by being overweight.

Medical Screening Examination Items

At enrollment (for which data are presented in this report), height and weight were measured at the MSE by a medical assistant using a Health-O-Meter adult height-weight scale. At exit, height and weight were measured by a registered nurse using either a Model 2102 Anthropometry Station or a Health-O-Meter adult height-weight scale.

Weight was measured in street clothes but without shoes and was recorded to the nearest quarter pound. If the examinee weighed more than 350 pounds, weight was recorded as 351 and interpreted as > 350 pounds. Height was measured without shoes and was recorded to the nearest quarter inch.

Two measurements of height and weight were taken on each person; the second measure immediately followed the first. For a subsample of about 3 percent of those taking the MSE, a repeat measurement of height and weight was taken about two hours later; it was given in the same manner as the first (i.e., two measures of height and weight were recorded).

For more details regarding the procedures for the measurement of height and weight, see Smith, Goldberg, Brook, et al., 1978.

Table 15

ITEMS INCLUDED IN THE MEDICAL HISTORY QUESTIONNAIRE TO MEASURE WEIGHT AND OVERWEIGHT IN THE HEALTH INSURANCE STUDY

Version One[a]		Version Two[b]	
Item[c]	Item Content	Item[d]	Item Content
1.	How tall are you without shoes on? _______feet _______inches	1	How tall are you without shoes on? _______feet _______inches
42.	How much do you weigh without heavy clothes? _______pounds	2.	How much do you weigh without heavy clothes? _______pounds
43.	What is the most you have ever weighed, not counting times when you were pregnant? _______pounds	26.	What is the most you have ever weighed? (Women: Do not count times when you were pregnant) _______pounds
44.	Do you think you weigh too much, or has a doctor or nurse told you that you now weigh too much? No . . . . 2 - (Go to q. 52, pg. 9) Yes . . . . 1 - (Go to q. 45)	27.	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much? Yes . . . . 1 - Answer 27-A-B-C-D-E-F-G-H No . . . . 2 - Go to 28, pg. 14
45.	Are you going to Weight Watchers, a reducing salon or exercise gym or health spa to lose weight? Yes . . . . 1 No 2	27-A.	Are you currently on a diet to lose weight? Yes . . . . 1 No 2
		27-B.	Are you doing any special exercises to lose weight? Yes . . . . 1 No 2
46.	Are you taking reducing pills which have been prescribed by a doctor? Yes . . . . 1 No 2	27-C.	Are you taking any reducing pills which have been prescribed by a doctor? Yes . . . . 1 No 2
47.	Are you currently on a diet to lose weight? Yes . . . . 1 No 2	27-D.	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight? Yes . . . . 1 No 2
48.	Are you currently under the care or supervision of a doctor to lose weight? Yes . . . . 1 No 2	27-E.	Are you currently under the care or supervision of a doctor to lose weight? Yes . . . . 1 No 2
49.	Are you doing any special exercises to lose we[illegible] Yes . . . . 1 No 2	27-F.	During the past 3 months, how much has your weight worried you or concerned you? A great deal . . . . . . 1 Somewhat . . . . 2 A little . . . . 3 Not at all 4
50.	During the past 3 months, how much has your weight worried you or concerned you? A lot . . . . 1 Somewhat . . . . . . 2 A little . . . . . . 3 Not at all 4	27-G.	During the past 3 months, how much pain has your weight caused you? A great deal of pain . . 1 Some pain . . . . 2 A little pain . . . . . 3 No pain at all 4
51.	During the past 3 months, how often has your weight kept you from doing the kinds of activities other people your age do? All of the time . . . 1 Most of the time . . 2 Some of the time . . 3 A little of the time 4 None of the time . . 5	27-H.	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do? All of the time . . . . 1 Most of the time . . . . 2 Some of the time . . . . 3 A little of the time . . 4 None of the time 5

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[a] Enrollment Medical History Questionnaire for Dayton only.

[b] Enrollment Medical History Questionnaire for Seattle, Fitchburg/Franklin Co., and Charleston/Georgetown Co.; Exit Medical History Questionnaire for all sites.

[c] Item number from Form A, Dayton Enrollment Medical History Questionnaire.

[d] Item number from Form A, Enrollment Medical History Questionnaire.

MEASURES OF WEIGHT AND OVERWEIGHT

A large number of measures of weight and overweight were constructed using HIS enrollment data. Some of these will be used as primary outcome measures to test experimental hypotheses. Some will be used as mediating variables, in analyses of models of health and health habits. Some will not be used in the HIS, but are presented here to provide information to other investigators who might prefer measures other than those we selected.

For each measure based on weight and height (e.g., W/H^2), we constructed two scores: one based on MHQ data and the other on MSE data.

Five levels of measurement (categorical, ordinal, interval, ratio, and absolute)[5] were represented in the measures. The mix of measurement levels for HIS weight measures should not pose a large analytic problem. Categorical and ordinal measures can be analyzed directly with polytomous logit regression (a kind of multigroup discriminant analysis) or can be converted to dummy varibles and analyzed through logit regression.

Table 16 presents a summary of the HIS measures, including the level of measurement and whether it was assessed based on MHQ or MSE data or both.

Weight and Height

For MHQ data, we scored weight in kilograms by multiplying weight in pounds by 0.4536. We scored height in meters by multiplying height in inches by 0.0254.

For MSE data, we obtained weight in pounds and height in inches either two or four times, as follows:

Time	Measure	Description	Sample
Early in the MSE	1a	Initial measure	All people taking the MSE
	1b	Immediate repeat of initial measure	
About 2 hours later	2a	Delayed repeat measure	3-percent sample of those taking the MSE
	2b	Immediate repeat of delayed repeat measure	

We computed weight in pounds and height in inches for all people taking the MSE as a rounded average of measures 1a and 1b. If the difference between measures 1a and 1b was greater than 3 percent of the average of the two measures, we

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[5] Categorical (sometimes called nominal) measures may have numeric values assigned to the categories, but the size and order of the number have no real meaning (e.g., 1—on a diet to lose weight, 2—not on a diet). Categorical measures with only two categories are termed binary categorical measures. Ordinal level measures are categorical measures in which the numeric values indicate the order of the categories along some continuum (e.g., 1—underweight, 2—normal weight, 3—overweight), but no information is conveyed regarding the magnitude of the difference between scale levels. Interval measures are those in which the values have a numeric meaning (i.e., the scores convey information regarding magnitude). Interval measures are usually, but not necessarily, continuous (take on a wide range of values). An example of an interval measure is W/H. Ratio measures have the same features as interval measures but in addition have an absolute zero point. An example is the difference between two weights. Absolute measures have the same features as ratio measures but the difference between scale values is absolute and cannot be transformed as in counts; i.e., one cannot transform a count of diseases and maintain the properties of this scale (see Lord and Novick, 1968).

See also Hays (1973) or Morris and Rolph (1978) for a discussion of classification of data.

Table 16

SUMMARY OF HEALTH INSURANCE STUDY MEASURES OF WEIGHT AND OVERWEIGHT

Type of Measure/Measure	Level of Measurement	MHQ	MSE
Weight and Height			
Weight in pounds	Ratio	Yes	Yes
Height in inches	Ratio	Yes	Yes
Maximum weight	Ratio	Yes	No
Weight Adjusted for Height			
W/H	Interval	Yes	Yes
$W/H^{1.5}$	Interval	Yes	Yes
W/H^2	Interval	Yes	Yes
Standardized W/H^p [a]	Interval	Yes	Yes
Relative Recommended Weight			
RRWN (NCHS recommended)	Interval	Yes	Yes
RRWL (life insurance recommended)	Interval	Yes	Yes
Overweight			
Self-evaluation	Binary categorical	Yes	No
Criterion-based	Ordinal	Yes	Yes
Weight Loss			
Difference between maximum weight and current weight	Ratio	Yes	No
Effects of Overweight			
Number of approaches to losing weight	Absolute	Yes	No
Under a doctor's care to lose weight	Binary categorical	Yes	No
Worry/concern over weight	Ordinal	Yes	No
Pain caused by weight	Ordinal	Yes	No
Restricted activity caused by weight	Ordinal	Yes	No
Overweight Impact Index	Ratio	Yes	No
Types of approaches to losing weight	Categorical	Yes	No

[a] For men, W/H^2 was used and for women, $W/H^{1.5}$.

assigned a missing value. (This occurred in less than 1 percent of the cases.) We used these "averaged" measures to derive the weight in kilograms and height in meters measures for the MSE data.

For the 3-percent sample of those people receiving the MSE on whom measures 2a and 2b were obtained, we also computed an average of the two second measures for purposes of calculating test-retest reliability coefficients.

Weight Adjusted for Height

We needed a continuous measure of weight adjusted for height to test hypotheses about body weight in relation to other variables. The most appropriate measure is one that is highly associated with weight but not associated with height. The measures that best met these criteria in most studies described in the literature were W/H^2 for men and either W/H or $W/H^{1.5}$ for women (see Section II). Before selecting these as the HIS measures of weight, however, we decided to test the two criteria (that the measure be highly associated with weight and not be associated with height) using data collected at the time of enrollment of the HIS population.

We thus constructed six measures from enrollment data: W/H, $W/H^{1.5}$, and W/H^2 based on MHQ data and the same three measures based on MSE data. Before calculating these functions, we transformed the HIS measures on weight in pounds and height in inches to weight in kilograms and height in meters.

In some cases, self-reported (MHQ) data on weight and height appeared to be unreliable and out of range (e.g., a 16 year old reported being 8 feet tall and weighing 145 pounds). In such cases, we recoded the questionable weight and height data to missing values and scored missing values for the W/H, $W/H^{1.5}$, and W/H^2 indexes. The following number of scores were recoded in this manner:

Site	Height	Weight
Dayton	1	0
Seattle	1	2
Fitchburg/Franklin County	0	1
Charleston/Georgetown County	4	1

We then calculated product-moment correlations for W/H, $W/H^{1.5}$, and W/H^2 with weight and height. In each site, we calculated correlation coefficients for five groups of people: men 14 years and older, women 14 years and older, men 20 years and older, women 20 years and older, and the total sample. Results are shown in Table 17.

For men, the findings are consistent with those observed in the literature. For all samples, the indicator W/H^2 is the least correlated with height and is also highly correlated with weight. Thus, the HIS analyses verified that W/H^2 is the best power-type indicator of weight for men.

For women, $W/H^{1.5}$ is the least correlated with height and highly correlated with weight. This is consistent with the NCHS findings (USDHEW, 1979b), but is in contrast with one major study (Florey, 1970) in which W/H best met these criteria (however, Florey did not evaluate $W/H^{1.5}$).

Because a different power function was used for men and women, we transformed the two indexes selected for use in the HIS (W/H^2 for men and $W/H^{1.5}$ for women) to standard scores (i.e., z scores) as follows:

$$z = \frac{W/H^p - \overline{W/H^p}}{S.D._{W/H^p}},$$

where we used the mean and standard deviation of W/H^p of men and women from the total sample. This transformation allows us to use the W/H^p index as a continuous measure without having to analyze data separately for men and women.

We calculated standard scores separately for MHQ and MSE data. The formula for MHQ data for men (N=2500) is

$$z = \frac{W/H^2 - 24.388}{3.804},$$

Table 17

PRODUCT-MOMENT CORRELATIONS[a] BETWEEN SELF-REPORTED MEASURES OF WEIGHT ADJUSTED FOR HEIGHT AND WEIGHT AND HEIGHT FOR PEOPLE AGED 14 TO 61 FROM ALL HEALTH INSURANCE STUDY SITES (Enrollment Medical History Questionnaire and Enrollment Medical Screening Examination)

Sample	Number[b]		W/H with Weight		$W/H^{1.5}$ with Weight		W/H^2 with Weight		W/H with Height		$W/H^{1.5}$ with Height		W/H^2 with Height	
	MHQ	MSE	MHQ	MSE	MHQ	MSE	MHQ	MSE	MHQ	MSE	MHQ	MSE	MHQ	MSE
Dayton														
Men aged 14 and older	561	288	.98	.98	.95	.96	.91	.92	.38	.35	.27	.25	.15	.15
Women aged 14 and older	631	329	.98	.98	.96	.96	.92	.93	(.08)	(.07)	(-.02)	(-.02)	-.12	(-.12)
Men aged [illegible] and older	447	229	.98	.98	.94	.94	.89	.90	.27	.25	.14	(.13)	(.02)	(.02)
Women aged 20 and older	524	265	.98	.98	.96	.96	.92	.92	(.10)	(.10)	(.00)	(.00)	-.10	(-.09)
Total sample	1203	[illegible]	.97	.97	.92	.92	.84	.86	.40	.36	.26	.22	.10	(.07)
Seattle														
Men aged 14 and older	943	485	.98	.98	.94	.94	.88	.89	.37	.30	.24	.19	.11	(.07)
Women aged 14 and older	1029	556	.98	.98	.96	.96	.93	.93	.14	.17	(.05)	(.08)	(-.04)	(-.01)
Men aged 20 and older	769	413	.97	.97	.93	.94	.86	.88	.26	.22	.13	(.10)	(-.01)	(-.04)
Women aged 20 and older	866	489	.98	.98	.96	.96	.94	.94	.12	.16	(.03)	(.07)	(-.06)	(-.02)
Total sample	2138	1041	.97	.97	.92	.93	.84	.87	.40	.36	.26	.23	.11	.09
Fitchburg														
Men aged 14 and older	213	174	.97	.98	.95	.95	[illegible]	.91	.26	.22	.23	(.12)	(.02)	(.01)
Women aged 14 and older	237	184	.98	.98	.96	.97	.94	.94	.18	(.17)	(.09)	(.09)	(.00)	(.00)
Men aged 20 and older	165	137	.97	.98	.94	.94	.86	.90	.20	.23	.19	(.11)	(-.07)	(-.01)
Women aged 20 and older	191	147	.98	.98	.96	.97	.94	.94	(.16)	(.15)	(.07)	(.06)	(-.02)	(-.02)
Total sample	467	358	.96	.97	.92	.93	.84	[illegible]	.34	.29	.23	.16	(.04)	(.02)
Franklin County														
Men aged 14 and older	258	205	.97	.98	.93	.94	[illegible]	.90	.35	.33	.22	.21	(.08)	(.09)
Women aged 14 and older	294	245	.98	.99	.96	.97	.93	.95	.19	(.16)	(.10)	(.08)	(.01)	(.00)
Men aged 20 and older	213	172	.97	.97	.92	.93	.85	.87	.22	.24	(.08)	(.11)	(-.06)	(-.03)
Women aged 20 and older	248	212	.98	.99	.96	.97	.94	.94	.17	(.17)	(.08)	(.09)	(-.01)	(.00)
Total sample	566	450	.97	.97	.92	.93	.84	.87	.39	.34	.25	.21	.10	(.07)
Charleston														
Men aged 14 and older	248	185	.98	.98	.94	.95	.89	.92	.20	.31	(.08)	.21	(-.03)	(.10)
Women aged 14 and older	317	236	.98	.99	.96	.97	.92	.95	(.11)	(.12)	(.05)	(.04)	(-.08)	(-.04)
Men aged 20 and older	200	140	.97	.97	.94	.94	.89	.90	(.14)	(.08)	(.02)	(-.04)	(-.10)	(-.15)
Women aged 20 and older	250	184	.98	.99	.97	.97	.94	.95	.16	(.11)	(.08)	(.02)	(-.01)	(-.06)
Total sample	586	421	.97	.97	.92	.94	.86	.88	.27	.24	.15	(.12)	(-.01)	(-.01)
Georgetown County														
Men aged 14 and older	277	203	.98	.98	.94	.96	.89	.92	[illegible]	.37	.20	.28	(-.08)	(.17)
Women aged 14 and older	313	264	.97	.99	.94	.97	.89	.94	[illegible]	(.09)	-.14	(.01)	-.24	(-.07)
Men aged 20 and older	210	159	.97	.98	.93	.95	.87	.90	(.15)	.26	(.02)	(.15)	(-.11)	(.03)
Women aged 20 and older	247	211	.98	.99	.95	.97	.91	.94	(.00)	(.03)	(-.11)	(-.05)	-.21	(-.13)
Total sample	614	467	.96	.97	.91	.93	.83	.88	.25	.26	(.08)	.14	(-.06)	(.00)
All Sites Combined														
Men aged 14 and older	2500	1540	.98	.98	.94	.95	.89	.91	.33	.31	.21	.20	.08	.09
Women aged 14 and older	2821	1814	.98	.98	.96	.96	.92	.94	.10	.12	(.00)	(.03)	-.09	-.06
Men aged 20 and older	2004	1250	.97	.97	.93	.94	.87	.89	.22	.20	.09	.08	(-.04)	(-.05)
Women aged 20 and older	2326	1508	.98	.98	.96	.96	.93	.94	.10	.10	(.01)	(.01)	-.09	-.08
Total sample	5574	3361	.97	.97	.92	.93	.84	.87	.35	.30	.21	.17	.06	(.04)

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[a] All correlation coefficients significant ($p < .01$) except those in parentheses.

[b] Total N does not always equal the sum of men and women because of missing values on the sex variable.

and for women (N=2821),

$$z = \frac{W/H^{1.5} - 30.008}{6.387}.$$

For MSE data, the formula for men (N=1540) is

$$z = \frac{W/H^{2} - 25.176}{4.106},$$

and for women (N=1814),

$$z = \frac{W/H^{1.5} - 31.344}{7.034}.$$

Relative Recommended Weight

We constructed four interval measures of RRW, two from data obtained from the MHQ and two from MSE data. These measures were constructed for purposes of comparison with other studies.

We used two sources of recommended weights and constructed separate RRW measures for each source. One was based on recommended weight obtained from life insurance company tables (Metropolitan Life Insurance Company, 1960). Recommended weight in these tables refers to the weight for a given height and sex at which a person has the best chance of survival. We obtained recommended weights separately for men and women, using the recommended weights in the tables for people of medium frame. Published recommended weights were taken in indoor clothing. The MHQ asked people how much they weighed without heavy clothing, and at the MSE people were weighed without shoes and heavy clothing. Therefore, we subtracted two pounds[6] from each tabled recommended weight to adjust for clothing. Heights as published in the recommended weight tables included heels; therefore, we subtracted one inch from tabled heights for men and two inches from heights for women (see Appendix C for a summary of these life insurance recommended weights).

The second source of recommended weight was based on the NCHS' definition of desirable weight as the mean weight (adjusted for height and sex) of people aged 20 to 29. These desirable weights were also obtained separately for men and women (USDHEW, 1979b) (see Appendix C for a summary of these desirable weights).

For each of these measures of RRW, we constructed one based on MHQ data and one based on MSE data. For all measures, we assigned missing values if a person's height did not appear in the table of recommended weight. A missing value was also assigned if HIS data were missing on either the height or weight item or on sex.

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[6] The Metropolitan Life Insurance Company recommends subtracting five pounds from the published weights for men and eight pounds for women to account for clothing. We decided that two pounds was a more realistic adjustment.

Overweight

We scored two measures of overweight: one based on the person's belief about being overweight (self-evaluation), and the other based on cutoff points applied to the weight adjusted for height measure (criterion-based).

Overweight: Self-Evaluation. This is a binary categorical variable (yes/no) based on a single item (item 44 and 27) and indicates whether the person believes he or she is overweight or has been told by a doctor or nurse that he or she is overweight.

Overweight: Criterion-Based. We constructed an ordinal index of overweight with three levels: (1) normal, (2) moderately overweight, and (3) severely overweight. Each level is defined in terms of specified criteria using the W/H^2 or $W/H^{1.5}$ index (for men and women, respectively). We based selection of the cutoff points for these categories on an analysis in which the prevalence of overweight was compared using four measures (relative recommended weight—NCHS recommended (RRWN), relative recommended weight—life insurance recommended (RRWL), W/H^2, and $W/H^{1.5}$) and several cutoff points for each measure. Table 18 summarizes the bases for the various cutoff points used in this analysis for each of the four measures. Table 19 summarizes the prevalence of overweight using these measures and criteria for data from all sites combined.

For men, the prevalence of overweight in all age groups using $W/H^2 \geq 27.0$ is comparable to RRWL ≥ 120 and to RRWN ≥ 110; that is, the prevalence of overweight in each age group is very similar for these three criteria. Similarly, $W/H^2 \geq 29.3$ is comparable to RRWL ≥ 130 and to RRWN ≥ 120. Thus, we will use these two values of W/H^2 (27.0 and 29.3) to define men who are normal, moderately overweight, and severely overweight.

For women, $W/H^{1.5} \geq 33.0$ is the value that provides an estimate of prevalence comparable to RRWL ≥ 120 and RRWN ≥ 110, and $W/H^{1.5} \geq 36.0$ corresponds to RRWL ≥ 130 and RRWN ≥ 120. Thus, we will use these two values of $W/H^{1.5}$ (33.0 and 36.0) to define women who are normal, moderately overweight, and severely overweight. These cutoff points were chosen somewhat arbitrarily and do *not* represent critical levels of these weight indexes that are associated with an increase in morbidity or mortality. An alternative way to define cutoff points would be to base them on the distribution (e.g., use quartiles or quintiles).

Weight Loss

We derived a ratio level measure of the difference between the person's maximum and current weight by subtracting current weight from the most the person ever weighed. In a few cases (less than 1 percent), this value was negative, indicating that the respondent had made an error. These respondents were assigned missing values on this measure, as were people with either of the items missing.

Effects of Overweight

We scored seven measures from items in the overweight battery, only for people who believed they were overweight or had been told by a doctor or nurse that they were overweight (only these people responded to the items involved). Item numbers mentioned below refer to version one and version two of the MHQ.

Table 18

Summary of Measures and Bases for Criteria Used To Compare Prevalence of Overweight

Measure	Criterion	Basis
Relative recommended weight (NCHS[a] recommended)	$\geq$ 110 $\geq$ 120	USDHEW, 1979b
	$\geq$ 130	To be comparable to life insurance company data
Relative recommended weight (life insurance recommended)	$\geq$ 110 $\geq$ 120 $\geq$ 130	Metropolitan Life Insurance Company, 1960; these are the most commonly reported criteria
W/H^2	$\geq$ 26.0	Lower bound established by the authors
	$\geq$ 27.0	The most commonly reported criterion (e.g., Keys, Aravanis, Blackburn, et al., 1972); this has been determined to be comparable to RRW $\geq$ 120 in women (James, 1976)
	$\geq$ 28.0	Intermediate value between 27.0 and upper criterion, selected by the authors
	$\geq$ 29.3	Dyer, Stamler, Berkson, et al., 1975
$W/H^{1.5}$	$\geq$ 32.0	Mean value of $W/H^{1.5}$ of women aged 20 to 74 in a general population (USDHEW, 1979b)
	$\geq$ 33.0	Selected by the authors
	$\geq$ 34.0	Selected by the authors
	$\geq$ 36.0	Selected by the authors
	$\geq$ 39.0	Mean plus one standard deviation of $W/H^{1.5}$ for women aged 20 to 74 (USDHEW, 1979b)

[a] National Center for Health Statistics.

Number of Approaches to Losing Weight. This is an absolute level variable and represents a count of the following five approaches taken to lose weight: diet, exercise, reducing pills, reducing program such as Weight Watchers, and doctor's care. Scores can thus range from zero to five. We obtained information on these approaches from items 45 to 49 and 27-A to 27-E. We assigned a missing value if any of these items were missing, or if item 27 or 44 was missing.

Under a Doctor's Care To Lose Weight. We scored a binary categorical variable from item 48 and 27-E indicating whether or not the person was currently under a doctor's care or supervision to lose weight. A score of one indicates that he or she is under a doctor's care; a score of zero indicates the contrary. We assigned a missing value if data were missing on this item or on item 44 or 27.

Worry/Concern over Weight. The extent of worry or concern people expressed about their weight during the last three months was scored as an ordinal level variable using four categories ranging from "not at all" to "a great deal." This

Table 19

PREVALENCE OF OVERWEIGHT IN THE HEALTH INSURANCE STUDY USING FOUR MEASURES AND SEVERAL CRITERIA: ALL SITES COMBINED
(Enrollment Medical History Questionnaire)

Sample	N[a]	Relative Recommended Weight (NCHS Recommended)			Relative Recommended Weight (Life Insurance Recommended)			Weight/Height^2				Weight/Height$^{1.5}$				
		Percent[b] $\geq$ 110	Percent $\geq$ 120	Percent $\geq$ 130	Percent $\geq$ 110	Percent $\geq$ 120	Percent $\geq$ 130	Percent $\geq$ 26.0	Percent $\geq$ 27.0	Percent $\geq$ 28.0	Percent $\geq$ 29.3	Percent $\geq$ 32.0	Percent $\geq$ 33.0	Percent $\geq$ 34.0	Percent $\geq$ 36.0	Percent $\geq$ 39.0
Total Sample	5815	22	12	7	40	23	13	24	20	15	10	38	31	26	17	9
Men	2584	21	8	3	44	22	10	28	21	15	9	51	42	33	21	9
14-18	460	4	3	1	10	5	3	5	4	4	3	13	8	7	4	3
19-29	800	18	8	3	41	19	8	25	18	13	8	50	41	32	18	9
30-39	580	27	12	5	53	28	14	35	27	18	12	61	50	40	27	13
40-49	366	32	11	4	60	32	14	40	32	24	12	67	57	47	31	14
50+	358	27	8	3	58	30	12	40	28	21	9	63	53	44	27	10
Women	2969	23	15	10	37	24	16	22	19	15	11	27	22	20	15	9
14-18	447	9	6	2	17	9	6	9	8	6	3	10	9	8	5	2
19-29	998	16	10	7	29	17	10	15	13	10	8	19	16	14	10	7
30-39	664	28	19	12	43	28	20	25	22	19	14	32	27	23	18	12
40-49	409	38	25	15	52	38	26	35	31	25	19	42	37	33	25	14
50+	425	32	21	14	55	35	22	31	27	22	17	39	31	27	21	13

[a] N for age groups does not equal total N because of missing data on age and/or sex.

[b] Percent is of those without missing data.

was scored from a single item (item 50 and 27-F). Values were reversed so that a high score indicated worry. We assigned a missing value if data were missing on either this item or on item 44 or 27.

Pain Caused by Weight. The extent of pain expressed by respondents that was caused by their weight during the last three months was scored as an ordinal level variable using four categories ranging from "none" to "a great deal." This was scored from a single item (item 27-G). We reversed the values so that a high score indicated pain. This variable was scored only for version two of the MHQ; the item was not included in version one. We assigned a missing value if data were missing on either this item or on item 44 or 27.

Restricted Activity Caused by Weight. The amount of time that a person's normal activities were restricted due to their weight during the last three months was scored as an ordinal level variable using five categories ranging from "none of the time" to "all of the time." This was scored from a single item (item 51 and 27-H). We reversed values so that a high score indicated restricted activity. We assigned a missing value if data were missing on either this item or on item 44 or 27.

Overweight Impact Index. We calculated an Overweight Impact Index as follows for the version two items (items 27-F, 27-G, 27-H):

1. Each item was linearly transformed so that no impact was scored as zero and the greatest impact scored as one.
2. The transformed scores were summed across the three items.
3. The sum was divided by three to obtain an average impact score.
4. A missing value was assigned if there were missing data on any of the items for a respondent.

The resulting score thus ranged from zero to one with the greatest impact equal to one; each question was weighted equally in the sum.

For the version one items, we followed the same procedure except we used only two items (items 50 and 51 pertaining to worry and restricted activity); we then divided the sum by two.

Types of Approaches To Losing Weight. We constructed a categorical measure to indicate the types of approaches overweight people were using to reduce. This measure was based on four items (27-A, 27-B, 27-C, 27-D, or 47, 49, 46, and 45 in Dayton) pertaining to diet, exercise, reducing pills, or an organization (e.g., Weight Watchers, reducing salon, exercise gym, or spa). We scored fifteen categories representing every combination of these four approaches (e.g., diet only; diet plus exercise). People missing one or more of the four items, or missing item 44 or 27, were assigned a missing value on this measure.

DESCRIPTIVE STATISTICS FOR MEASURES OF WEIGHT AND OVERWEIGHT

Item Frequencies

We summarize the frequency and percentage distributions of responses to the weight and overweight items in the enrollment MHQ in Tables D.1 to D.6 in Appendix D for each of the six sites. The amount of missing data was very small, generally less than 3 percent missing on any one item. We observed more missing data in Charleston and Georgetown County than in the other sites (as much as 6 percent on some items).

Weight and Height

Summary statistics for weight in pounds, height in inches, and maximum weight in pounds based on enrollment MHQ items are presented in Table E.1 in Appendix E, and for weight in pounds and height in inches obtained at the enrollment MSE in Table E.2. We have not reported data on weight in kilograms and height in meters; these measures were used only to calculate the weight-for-height indices.

Weight Adjusted for Height

Tables 20, 21, and 22 give summary statistics for W/H, W/H$^{1.5}$, and W/H^{2}, respectively, for both the MHQ and the MSE. We present data for each of the six sites and for all sites combined, and summarize data separately by sex as well as for the total sample. These data are broken down by age and sex for W/H^{2} for men and for W/H$^{1.5}$ for women (see Table 23). Appendix E presents deciles of W/H^{2} for men, W/H$^{1.5}$ for women, and W/H^{p} for the total sample.

The values presented in these tables are intended to provide some indication of the values in this population as a whole. To use these values clinically, they may need to be broken down further (e.g., according to ethnic group).

Women consistently show more variability than men on all three measures, as indicated by a generally wider range and higher standard deviations. This is consistent with the findings of other investigators (Society of Actuaries, 1959). The mean W/H, W/H$^{1.5}$, and W/H^{2} was consistently higher for men, and consistently higher when based on MSE data compared with MHQ data.

Relative Recommended Weight

Summary statistics for relative recommended weight (RRW) are given in Table 24 for RRWN (NCHS recommended) and in Table 25 for RRWL (life insurance recommended). We present data for both the MHQ and the MSE for each of the six sites and for all sites combined, and summarize the data by sex as well as for the total sample.

The mean RRWN was, on average, about 10 percent lower (mean of 99) than the mean RRWL (mean of 109) (figures based on total sample). For both RRW measures, the mean was about 4 percent higher (on average) using MSE data compared with MHQ data. Women tended to have both a higher mean RRW and a more variable RRW than men in all sites for both RRW measures.

Overweight and Its Effects

Table 26 gives summary statistics for measures of maximum weight less current weight and the Overweight Impact Index based on data from the MHQ for each of the six sites, for all sites combined, and broken down by sex. The mean difference was roughly comparable across the sites and for men and women (about 11 pounds). The effect of overweight was greater for women in all sites.

Table 20

SUMMARY STATISTICS FOR W/H FOR PEOPLE AGED 14 TO 61 IN SIX SAMPLES
(Enrollment Medical History Questionnaire and
Enrollment Medical Screening Examination)

	Medical History Questionnaire				Medical Screening Examination			
Site/Sample	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Dayton								
Men	561	43.24	7.20	24.88-65.24	288	43.21	7.25	25.50-65.65
Women	631	37.78	7.50	25.67-78.13	329	38.41	7.64	25.23-69.73
Total	1203	40.36	7.84	24.88-78.13	624	40.62	7.80	25.23-69.73
Seattle								
Men	943	42.76	6.34	24.24-75.84	485	43.94	6.69	26.64-73.63
Women	1029	37.79	7.78	24.42-87.92	556	39.25	8.16	25.51-83.34
Total	2138	40.14	7.50	24.24-87.92	1041	41.44	7.86	25.51-83.34
Fitchburg								
Men	213	44.00	7.58	25.35-82.24	174	44.71	7.25	27.20-70.38
Women	237	39.28	9.06	23.24-81.17	184	40.80	9.83	24.94-81.17
Total	467	41.52	8.66	23.24-82.24	358	42.70	8.88	24.94-81.17
Franklin County								
Men	258	43.34	7.19	24.09-75.46	205	44.55	7.91	26.08-77.04
Women	294	38.52	7.83	26.65-78.63	245	40.18	9.00	26.93-87.28
Total	566	40.74	7.86	24.09-78.63	450	42.17	8.79	26.08-87.28
Charleston								
Men	248	42.91	7.60	25.51-86.07	185	42.99	8.27	24.20-80.36
Women	317	38.82	9.07	23.62-75.76	236	40.22	10.27	25.30-77.19
Total	586	40.62	8.65	23.62-86.07	421	41.44	9.53	24.20-80.36
Georgetown County								
Men	277	43.93	8.20	22.32-86.81	203	44.79	8.38	27.94-82.53
Women	313	39.76	9.26	25.11-100.12	264	41.68	10.06	24.94-88.26
Total	614	41.54	8.95	22.32-100.12	467	43.03	9.48	24.94-88.26
All Sites Combined								
Men	2500	43.18	7.09	22.32-86.81	1540	43.97	7.48	24.20-82.53
Women	2821	38.33	8.19	23.24-100.12	1814	39.86	9.00	24.94-88.26
Total	5574	40.57	8.02	22.32-100.12	3361	41.74	8.58	24.20-88.26

[a] Number of people with complete data.

Table 21

SUMMARY STATISTICS FOR W/H$^{1.5}$ FOR PEOPLE AGED 14 TO 61 IN SIX SAMPLES (Enrollment Medical History Questionnaire and Enrollment Medical Screening Examination)

Site/Sample	Medical History Questionnaire				Medical Screening Examination			
	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Dayton								
Men	561	32.45	5.20	19.70-47.69	288	32.65	5.31	20.02-48.89
Women	631	29.61	5.84	18.86-61.28	329	30.23	5.99	19.94-55.12
Total	1203	30.96	5.72	18.86-61.28	624	31.33	5.78	19.94-55.12
Seattle								
Men	943	32.04	4.56	20.32-55.69	485	33.16	4.90	21.06-54.08
Women	1029	29.49	6.02	18.58-68.42	556	30.70	6.30	20.17-65.88
Total	2138	30.69	5.48	18.58-68.42	1041	31.84	5.82	20.17-65.88
Fitchburg								
Men	213	33.15	5.50	20.20-59.19	174	33.94	5.41	21.17-53.55
Women	237	30.95	7.[illegible]	18.38-62.69	184	32.30	7.70	19.72-62.69
Total	467	31.99	6.42	18.38-62.69	358	33.10	6.73	19.72-62.69
Franklin County								
Men	258	32.60	5.20	19.05-56.19	205	33.67	5.79	20.62-57.78
Women	294	30.16	6.03	20.43-60.27	245	31.56	6.99	21.29-69.55
Total	566	31.28	5.75	19.05-60.27	450	32.52	6.55	20.62-69.55
Charleston								
Men	248	32.35	5.65	20.17-63.64	185	32.59	6.14	19.28-63.03
Women	317	30.48	7.05	18.82-58.52	236	31.70	8.03	20.49-61.51
Total	586	31.28	6.50	18.82-63.64	421	32.09	7.27	19.28-63.03
Georgetown County								
Men	277	33.18	5.98	18.08-64.19	203	34.02	6.13	22.26-60.20
Women	313	31.20	7.37	19.70-80.44	264	32.91	7.91	19.72-66.66
Total	614	31.98	6.77	18.08-80.44	467	33.39	7.21	19.72-66.66
All Sites Combined								
Men	2500	32.44	5.15	18.08-64.19	1540	33.26	5.50	19.28-63.03
Women	2821	30.01	6.39	18.38-80.44	1814	31.34	7.03	19.72-69.55
Total	5574	31.12	5.92	18.08-80.44	3361	32.22	6.44	19.28-69.55

[a] Number of people with complete data.

Table 22

Summary Statistics for W/H² for People Aged 14 to 61 in Six Samples
(Enrollment Medical History Questionnaire and Enrollment Medical Screening Examination)

	Medical History Questionnaire				Medical Screening Examination			
Site/Sample	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Dayton								
Men	561	24.36	3.80	15.45-35.26	288	24.68	3.94	15.35-36.40
Women	631	23.22	4.61	13.85-48.06	329	23.80	4.74	15.76-43.58
Total	1203	23.76	4.28	13.85-48.06	624	24.19	4.38	15.35-43.58
Seattle								
Men	943	24.03	3.34	16.82-40.90	485	25.02	3.65	16.65-41.04
Women	1029	23.02	4.71	14.14-53.25	556	24.01	4.91	15.82-52.08
Total	2138	23.48	4.10	14.14-53.25	1041	24.48	4.39	15.82-52.08
Fitchburg								
Men	213	24.99	4.06	16.10-42.60	174	25.78	4.09	16.47-40.75
Women	237	24.39	5.56	14.53-48.42	184	25.58	6.08	15.59-50.19
Total	467	24.66	4.88	14.53-48.42	358	25.67	5.20	15.59-50.19
Franklin County								
Men	258	24.54	3.84	15.06-41.84	205	25.46	4.30	16.30-43.33
Women	294	23.63	4.69	15.66-46.20	245	24.80	5.47	16.83-55.42
Total	566	24.04	4.31	15.06-46.20	450	25.10	4.98	16.30-55.42
Charleston								
Men	248	24.40	4.27	14.64-47.93	185	24.71	4.62	15.36-49.43
Women	317	23.94	5.54	15.00-45.90	236	24.99	6.33	16.60-49.02
Total	586	24.11	4.98	14.64-47.93	421	24.87	5.64	15.36-49.44
Georgetown County								
Men	277	25.08	4.43	14.65-47.47	203	25.85	4.54	17.68-43.91
Women	313	24.50	5.94	14.23-64.62	264	25.99	6.28	15.59-52.51
Total	614	24.65	5.26	14.12-64.62	467	25.93	5.58	15.59-52.51
All Sites Combined								
Men	2500	24.39	3.80	14.64-47.93	1540	25.17	4.10	15.35-49.43
Women	2821	23.51	5.03	13.85-64.62	1814	24.65	5.54	15.59-55.42
Total	5574	23.89	4.48	13.85-64.62	3361	24.89	4.94	15.35-55.42

[a] Number of people with complete data.

Table 23

SUMMARY STATISTICS FOR W/H^2 FOR MEN AND $W/H^{1.5}$ FOR WOMEN AGED 14 TO 61 BY AGE
(Enrollment Medical History Questionnaire and Enrollment Medical Screening Examination)

	Medical History Questionnaire				Medical Screening Examination			
Sex, Age Group	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Men (W/H^2)								
14-19	477	21,55	3.28	14.64-41.14	290	21.62	3.04	15.35-36.40
20-29	741	24.33	3.64	15.45-47.06	408	24.86	3.75	16.64-39.70
30-39	564	25.30	3.54	15.62-41.84	389	26.29	3.84	18.65-43.33
40-49	356	25.72	3.38	17.42-42.37	227	26.64	3.47	19.87-43.91
50+	343	25.55	3.69	16.82-47.93	226	26.93	4.07	18.70-49.44
All ages	2500	24.39	3.80	14.64-47.93	1540	25.17	4.10	15.35-49.43
Women ($W/H^{1.5}$)								
14-19	473	27.18	5.19	18.58-80.44	306	28.39	5.64	19.94-69.55
20-29	904	29.01	5.66	18.82-59.27	532	30.26	6.14	19.72-59.27
30-39	637	31.04	7.03	18.38-68.42	450	31.82	7.51	18.72-65.88
40-49	389	32.25	6.76	20.43-61.28	246	34.18	8.00	22.63-66.66
50+	396	31.85	6.23	20.27-58.09	280	33.37	6.69	20.53-61.96
All ages	2821	30.01	6.39	18.38-80.44	1814	31.34	7.03	19.72-69.55

[a] Number of people with complete data.

Percentage distributions of six measures pertaining to overweight are shown in Table 27 for each of the six sites, for all sites combined, and broken down by sex. Within each site, from 29 to 46 percent of the people believe they are overweight or have been told by a doctor or nurse that they are now overweight (median 41 percent of six sites). Of the people who think they are or have been told that they are overweight, about half (from 51 to 61 percent) are not taking steps to try to lose weight. Within each site, from 84 to 91 percent of those who believe they are overweight worry at least a little about their weight. Eighteen percent of the people who believe they are overweight attribute pain to their being overweight or experience restricted activity due to their weight.

Women were generally more likely than men to attempt to lose weight, to worry about their weight, to experience pain caused by their weight, and to restrict their activity because of their weight.

An average of 7 percent of people are under a doctor's care to lose weight. This ranged from 4 to 11 percent across sites. Women were more likely than men to be under a doctor's care in five of six sites.

A summary of the types of approaches overweight people[7] take to reduce is presented in Table 28 for data from all sites combined. The most prevalent approaches are diet and exercise: About 35 percent of the people who believe they are

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[7] People who think they weigh too much or have been told by a doctor or nurse that they weigh too much.

Table 24

Summary Statistics for Relative Recommended Weight (NCHS Recommended) for People Aged 14 to 61 in Six Samples
(Enrollment Medical History Questionnaire and Enrollment Medical Screening Examination)

	Medical History Questionnaire				Medical Screening Examination			
Site/Sample	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Dayton								
Men	538	98.4	15.3	62-143	277	99.8	15.8	62-147
Women	626	99.0	19.5	67-204	328	101.0	20.0	66-184
Total	1164	98.7	17.6	62-204	605	100.5	18.2	62-184
Seattle								
Men	895	96.9	13.5	68-166	477	100.9	14.8	67-165
Women	1013	98.3	20.1	62-229	546	102.5	21.0	67-219
Total	1908	97.7	17.4	62-229	1023	101.8	18.4	67-219
Fitchburg								
Men	205	100.0	15.4	65-151	172	103.6	16.4	66-164
Women	235	103.4	23.6	61-208	183	107.8	25.7	66-209
Total	440	101.8	20.2	61-208	355	105.8	21.8	66-209
Franklin County								
Men	242	98.8	15.2	61-169	196	102.3	17.3	66-175
Women	294	100.6	20.1	68-201	244	105.4	23.4	71-233
Total	536	99.8	18.0	61-201	440	104.1	20.9	66-233
Charleston								
Men	239	98.3	16.6	64-192	180	99.8	18.4	62-199
Women	310	102.0	23.7	63-194	235	105.9	26.9	69-206
Total	549	100.4	21.0	63-194	415	103.3	23.7	62-206
Georgetown County								
Men	261	101.6	17.5	67-192	200	104.2	18.3	71-178
Women	304	103.8	23.8	66-269	263	109.9	26.5	66-221
Total	565	102.8	21.1	66-269	463	107.4	23.4	66-221
All Sites Combined								
Men	2380	98.4	15.1	61-192	1502	101.5	16.5	62-199
Women	2782	100.2	21.2	61-269	1799	104.7	23.5	66-233
Total	5162	99.3	18.7	61-269	3301	103.3	20.7	62-233

[a] Number of people with complete data.

Table 25

SUMMARY STATISTICS FOR RELATIVE RECOMMENDED WEIGHT (LIFE INSURANCE RECOMMENDED) FOR PEOPLE AGED 14 TO 61 IN SIX SAMPLES
(Enrollment Medical History Questionnaire and
Enrollment Medical Screening Examination)

	Medical History Questionnaire				Medical Screening Examination			
Site/Sample	N[a]	Mean	S.D.	Range	N[a]	Mean	S.D.	Range
Dayton								
Men	549	109.0	17.2	69-158	286	110.6	17.7	69-163
Women	627	108.0	21.3	73-223	328	110.6	22.1	74-203
Total	1176	108.5	19.5	69-223	614	110.6	20.1	69-203
Seattle								
Men	918	107.6	15.0	75-183	482	112.1	16.4	73-183
Women	1013	107.0	21.9	66-247	548	111.6	22.9	73-243
Total	1931	107.3	18.9	66-247	1030	111.9	20.1	73-243
Fitchburg								
Men	208	111.1	17.1	70-167	174	115.4	18.3	74-182
Women	235	113.2	25.7	68-225	183	118.4	28.0	73-232
Total	443	112.2	22.1	68-225	357	116.9	23.8	73-232
Franklin County								
Men	250	109.7	17.2	66-188	200	113.5	19.2	72-194
Women	294	109.8	21.8	73-215	244	115.3	25.5	79-258
Total	544	109.7	19.8	66-215	444	114.5	22.9	72-258
Charleston								
Men	246	109.1	18.4	70-214	182	110.7	20.5	67-220
Women	310	111.3	25.8	70-212	236	116.0	29.4	77-228
Total	556	110.3	22.8	70-214	418	113.7	26.0	67-228
Georgetown County								
Men	270	112.8	19.6	70-213	203	115.6	20.4	78-197
Women	305	113.4	26.39	72-300	263	120.5	29.1	73-241
Total	575	113.1	23.44	70-300	466	118.4	25.7	73-241
All Sites Combined								
Men	2441	109.2	16.9	66-214	1527	112.7	18.4	67-220
Women	2784	109.2	23.2	66-300	1802	114.5	25.7	73-258
Total	5225	109.2	20.5	66-300	3329	113.6	22.7	67-258

[a] Number of people with complete data.

Table 26

SUMMARY STATISTICS FOR TWO HEALTH INSURANCE STUDY MEASURES PERTAINING TO OVERWEIGHT (Enrollment Medical History Questionnaire)

	Maximum Weight Less Current Weight				Overweight Impact Index[a]			
Site/Sample	N[b]	Mean	S.D.	Range	N[c]	Mean	S.D.	Range
Dayton								
Men	552	11.23	12.38	0-95	169	0.22	0.18	0.00-0.88
Women	619	10.19	11.00	0-65	279	0.31	0.21	0.00-1.00
Total	1181	10.69	11.72	0-95	454	0.28	0.20	0.00-1.00
Seattle								
Men	961	11.44	11.22	0-85	320	0.15	0.12	0.00-0.69
Women	1032	12.55	13.51	0-110	620	0.27	0.19	0.00-1.00
Total	2159	12.12	12.62	0-124	1018	0.23	0.18	0.00-1.00
Fitchburg								
Men	211	11.79	12.54	0-83	66	0.12	0.10	0.00-0.39
Women	235	13.23	14.90	0-100	137	0.24	0.18	0.00-0.92
Total	463	12.37	13.68	0-100	210	0.20	0.17	0.00-0.92
Franklin County								
Men	260	13.80	14.99	0-110	84	0.15	0.13	0.00-0.61
Women	293	12.10	12.89	0-100	170	0.21	0.16	0.00-0.83
Total	567	12.89	13.85	0-110	261	0.18	0.15	0.00-0.83
Charleston								
Men	249	10.78	12.36	0-85	61	0.19	0.15	0.00-0.81
Women	310	11.29	12.28	0-81	146	0.29	0.22	0.00-1.00
Total	580	11.28	13.11	0-108	215	0.26	0.21	0.00-1.00
Georgetown County								
Men	267	9.71	11.04	0-70	53	0.16	0.17	0.00-0.72
Women	310	9.57	10.78	0-85	140	0.26	0.20	0.00-0.83
Total	601	9.65	10.90	0-85	195	0.23	0.20	0.00-0.83
All Sites Combined								
Men	2029	11.07	11.67	0-95	753	0.17	0.14	0.00-0.88
Women	2271	11.33	12.40	0-110	1492	0.27	0.20	0.00-1.00
Total	4521	11.31	12.27	0-124	2353	0.23	0.18	0.00-1.00

[a] Scored only for those who think they weigh too much or have been told by a doctor or nurse that they weigh too much.

[b] Number of people with complete data; the total number does not necessarily equal the sum of men plus women due to missing values on the sex variable.

[c] Number of people with complete data who believe they weigh too much or have been told by a doctor or nurse that they weigh too much; the total number does not necessarily equal the sum of men plus women due to missing values on the sex variable.

Table 27

PERCENTAGE DISTRIBUTIONS OF SIX HEALTH INSURANCE STUDY MEASURES PERTAINING TO OVERWEIGHT

(Enrollment Medical History Questionnaire)

		Dayton			Seattle			Fitchburg		
Measure	Response	Men (N=569)	Women (N=632)	Total (N=1212)[a]	Men (N=979)	Women (N=1088)	Total (N=2235)[a]	Men (N=216)	Women (N=249)	Total (N=483)[a]
Whether person believes he/she is overweight	Yes	29.7	44.1	37.5	32.8	57.4	45.8	31.0	55.0	43.7
	No	70.3	55.9	62.5	67.2	42.6	54.1	65.5	44.6	55.9
	Missing	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.4	0.4
		100.0	100.0	100.0	100.0	100.1[b]	99.9[b]	100.0	100.0	100.0
[The following measures pertain only to those who are overweight[c]]:		(N=169)	(N=279)	(N=454)	(N=321)	(N=624)	(N=1024)	(N=67)	(N=137)	(N=211)
Count of number of approaches to losing weight	0	69.2	46.2	55.3	67.9	44.4	52.4	70.1	43.1	51.7
	1	18.3	24.7	22.2	21.2	24.2	23.1	13.4	27.7	23.2
	2	7.7	19.4	14.8	8.4	21.3	17.0	11.9	19.7	17.5
	3-5	4.2	9.3	7.3	2.2	8.3	6.2	4.5	8.0	6.6
	Missing	0.6	0.4	0.4	0.3	1.8	1.3	0.0	1.5	0.9
	Not overweight	--	--	--	--	--	--	--	--	--
		100.0	100.0	100.0	100.0	100.0	100.0	99.9[b]	100.0	99.9[b]
Worry and concern over weight	4-A great deal	8.3	27.6	17.2	5.6	31.9	22.5	1.5	21.9	15.2
	3-Somewhat	19.5	2[illegible].2	23.6	22.4	30.6	27.8	14.9	29.2	24.2
	2-A little	54.4	[illegible].0	47.6	56.4	33.0	40.8	55.2	36.5	41.7
	1-Not at all	17.8	8.2	11.7	15.3	4.5	8.7	28.4	12.4	19.0
	Missing	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0
	Not overweight	--	--	--	--	--	--	--	--	--
		100.0	100.0	100.1[b]	100.0	100.0	100.0	100.0	100.0	100.1[b]
Pain caused by weight	4-A great deal				0.0	2.4	1.6	0.0	0.7	0.5
	3-Some				2.2	6.9	5.0	0.0	7.3	4.7
	2-A little		Not measured		6.9	9.8	8.7	10.4	13.1	11.8
	1-None				91.0	80.6	84.6	83.0	78.8	82.5
	Missing				0.0	0.3	0.2	1.5	0.0	0.5
	Not overweight				--	--	--	--	--	--
					100.1[b]	100.0	100.1[b]	99.9[b]	99.9[b]	100.0
Restricted activity caused by weight	5-All of the time	0.0	1.1	0.7	0.0	0.5	0.3	0.0	0.0	0.0
	4-Most of the time	1.2	2.9	2.2	0.6	1.9	1.4	0.0	2.2	1.4
	3-Some of the time	4.1	4.7	4.6	2.2	7.4	5.3	3.0	8.0	6.2
	2-Little of the time	8.9	6.8	7.5	5.0	12.2	9.7	4.5	13.9	10.9
	1-None of the time	85.8	84.6	85.0	92.2	77.7	83.2	92.5	75.9	81.5
	Missing	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0
	Not overweight	--	--	--	--	--	--	--	--	--
		100.0	100.1[b]	100.0	100.0	100.0	100.1[b]	100.0	100.0	100.0
Under a doctor's care to lose weight	1-Yes	7.7	13.6	11.2	1.9	6.3	4.9	7.5	8.0	7.6
	0-No	92.3	86.4	88.8	98.1	93.8	95.1	92.5	92.0	92.4
	Missing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		100.0	100.0	100.0	100.0	100.1[b]	100.0	100.0	100.0	100.0

Measure	Response	Franklin County			Charleston			Georgetown County			All Sites Combined		
		Men (N=265)	Women (N=306)	Total (N=585)	Men (N=262)	Women (N=348)	Total (N=634)	Men (N=293)	Women (N=346)	Total (N=666)	Men (N=2584)	Women (N=2969)	Total (N=5815)[a]
Whether person believes he/she is overweight	Yes	31.7	55.6	44.6	23.3	42.5	34.2	18.4	40.5	29.4	29.3	50.5	40.6
	No	67.9	44.4	55.2	76.3	56.6	65.1	81.6	59.2	70.3	70.6	49.3	59.2
	Missing	0.4	0.0	0.2	0.4	0.9	0.6	0.0	0.3	0.3	0.1	0.2	0.2
		100.0	100.0	100.0	100.0	100.0	99.9[b]	100.0	100.0	100.0	100.0	100.0	100.0
[The following measures pertain only to those who are overweight[c]]:		(N=84)	(N=170)	(N=261)	(N=61)	(N=148)	(N=217)	(N=54)	(N=140)	(N=196)	(N=756)	(N=1498)	(N=2363)
Count of number of approaches to losing weight	0	69.0	49.4	56.7	68.9	47.3	54.4	74.1	57.1	61.7	69.0	46.7	54.3
	1	15.5	24.7	21.5	16.4	20.3	18.9	16.7	24.3	22.4	18.5	24.3	22.3
	2	10.7	18.8	15.7	8.2	20.9	17.0	9.2	14.3	12.8	8.9	19.8	16.1
	3-5	3.6	3.5	3.5	6.6	9.5	8.3	0.0	1.4	1.0	3.2	7.4	5.9
	Missing	1.2	3.5	2.7	0.0	2.0	1.4	0.0	2.9	2.0	0.4	1.8	1.3
	Not overweight	--	--	--	--	--	--	--	--	--	--	--	--
		100.0	99.9[b]	100.1[b]	100.1[b]	100.0	100.0	100.0	100.0	99.9[b]	100.0	100.0	99.9[b]
Worry and concern over weight	4-A great deal	6.0	21.2	16.1	3.3	28.4	21.6	9.3	26.4	21.4	6.0	27.2	19.9
	3-Somewhat	21.4	25.3	23.4	31.1	27.7	28.6	16.7	17.9	17.3	21.3	27.6	25.4
	2-A little	50.0	42.4	44.4	55.7	35.8	41.5	37.0	41.4	39.9	53.7	37.3	42.6
	1-Not at all	22.6	11.2	16.1	9.8	8.1	8.3	35.2	14.3	20.9	18.8	7.9	12.0
	Missing	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.5	0.3	0.0	0.1
	Not overweight	--	--	--	--	--	--	--	--	--	--	--	--
		100.0	100.1[b]	100.0	99.9[b]	100.0	100.0	100.0	100.0	100.0	100.1[b]	100.0	100.0
Pain caused by weight	4-A great deal	0.0	1.8	1.1	0.0	4.0	2.8	0.0	3.6	2.6	0.0[d]	2.5[d]	1.6[d]
	3-Some	1.2	2.4	1.9	3.3	8.1	7.4	3.7	7.1	6.1	2.0	6.5	4.9
	2-A little	13.1	7.6	9.2	19.7	16.2	17.0	20.4	21.4	20.9	10.7	12.0	11.3
	1-None	85.7	88.2	87.7	77.0	70.3	71.9	75.9	67.9	70.4	87.0	78.8	81.9
	Missing	0.0	0.0	0.0	0.0	1.4	0.9	0.0	0.0	0.0	0.2	0.3	0.3
	Not overweight	--	--	--	--	--	--	--	--	--	--	--	--
		100.0	100.0	99.9[b]	100.0	100.0	100.0	100.0	100.0	100.0	99.9[b]	100.1[b]	100.0
Restricted activity caused by weight	5-All of the time	0.0	0.0	0.0	0.0	1.4	0.9	0.0	0.7	0.5	0.0	0.6	0.4
	4-Most of the time	0.0	0.0	0.0	1.6	4.0	3.2	0.0	0.7	0.5	0.7	2.0	1.5
	3-Some of the time	1.2	4.7	3.4	3.3	10.1	8.3	3.7	8.6	7.1	2.8	7.0	5.5
	2-Little of the time	8.3	7.6	7.7	11.5	14.2	14.7	11.1	16.4	14.8	7.1	11.4	10.0
	1-None of the time	90.5	87.6	88.9	83.6	70.3	72.8	85.2	73.6	77.0	89.4	78.8	82.6
	Missing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Not overweight	--	--	--	--	--	--	--	--	--	--	--	--
		100.0	99.9[b]	100.0	100.0	100.0	99.9[b]	100.0	100.0	99.9[b]	100.0	99.9[b]	100.1[b]
Under a doctor's care to lose weight	1-Yes	3.6	4.1	3.8	6.6	10.8	9.2	7.4	6.4	6.6	4.6	8.0	6.8
	2-No	96.4	95.3	95.8	93.4	88.5	90.3	92.6	92.9	92.9	95.4	91.8	93.1
	Missing	0.0	0.6	0.4	0.0	0.7	0.5	0.0	0.7	0.5	0.0	0.2	0.1
		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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[a] The total number does not necessarily equal the sum of men plus women due to missing values on the sex variable.

[b] Does not equal 100.0 due to rounding error.

[c] Defined as those who think they weigh too much or have been told by a doctor or nurse that they weigh too much.

[d] Percentage of those except in Dayton where this item was not asked (N=1909).

Table 28

TYPES OF APPROACHES OVERWEIGHT PEOPLE[a] TAKE TO REDUCE
(Enrollment Medical History Questionnaire)

Approaches Taken	Number	Percent
None	1286	54.4
Diet only	323	13.7
Exercise only	254	10.7
Diet and exercise	239	10.1
Diet, exercise, and organization[b]	61	2.6
Diet and organization	49	2.1
Diet and pills	39	1.6
Exercise and organization	25	1.0
Diet, exercise, and pills	18	0.8
Organization only	15	0.6
Pills only	13	0.6
Diet, exercise, pills, and organization	9	0.4
Diet, pills, and organization	2	0.1
Exercise and pills	1	0.0
Exercise, pills, and organization	1	0.0
Pills and organization	0	0.0
Missing approach variable	28	1.2
Total	2363	99.9[c]

[a] People who either think they weigh too much or have been told by a doctor or nurse that they weigh too much.

[b] Weight Watchers, reducing salon, exercise gym, or health spa.

[c] Does not equal 100.0 due to rounding error.

overweight are either on a diet or doing exercises or both in an attempt to reduce; only about 3.5 percent are taking pills to help them reduce.

Overweight Based on Criteria

Frequency distributions for the three categories of overweight (normal, moderately overweight, severely overweight) based on the HIS criteria for the W/H^2 and $W/H^{1.5}$ measures are presented in Table 29 for each site and for all sites combined. We present data separately for men and women as well as for the total sample.

The percentage of people who are overweight (either moderately or severely) is higher when the estimate is based on MSE data rather than MHQ data. This is due to the tendency for self-reported weight to be less than actual weight. The percentage of people who are at all overweight based on MHQ data averages 22 in all sites combined and ranges from 18 in Seattle to 30 in Georgetown County.

Table 29

Frequency Distributions for Categories of Overweight

	Medical History Questionnaire							Medical Screening Examination						
		(1) Normal		(2) Moderately Overweight		(3) Severely Overweight			(1) Normal		(2) Moderately Overweight		(3) Severely Overweight	
Site/Sample	N[a]	Number	Percent	Number	Percent	Number	Percent	N[a]	Number	Percent	Number	Percent	Number	Percent
Dayton														
Men	561	426	75.9	82	14.6	53	9.4	289	207	71.6	49	17.0	33	11.4
Women	631	505	80.0	47	7.4	79	12.5	330	249	75.4	33	10.0	48	14.5
Total	1192	931	78.1	129	10.8	132	11.1	619	456	73.7	82	13.2	81	13.1
Seattle														
Men	943	791	83.9	92	9.8	60	6.4	485	356	73.4	76	15.7	53	10.9
Women	1029	833	81.0	73	7.1	123	12.0	558	415	74.4	51	9.1	92	16.5
Total	1972	1626	82.4	165	8.4	183	9.3	1043	771	73.9	127	12.2	145	13.9
Fitchburg														
Men	213	158	74.2	29	13.6	26	12.2	174	114	65.5	29	16.7	31	17.8
Women	237	171	72.2	16	6.8	50	21.1	185	126	68.1	11	5.9	48	25.9
Total	450	329	73.1	45	10.0	76	16.9	359	240	66.8	40	11.1	79	22.0
Franklin County														
Men	258	201	77.9	33	12.8	24	9.3	206	144	69.9	31	15.0	31	15.0
Women	294	232	78.9	22	7.5	40	13.6	246	176	71.5	27	11.0	43	17.5
Total	552	433	78.4	55	10.0	64	11.6	452	320	70.8	58	12.8	74	16.4
Charleston														
Men	248	196	79.0	30	12.1	22	8.9	186	139	74.7	15	8.1	32	17.2
Women	317	233	73.5	23	7.3	61	19.2	238	157	66.0	21	8.8	60	25.2
Total	565	429	75.9	53	9.4	83	14.7	424	296	69.8	36	8.5	92	21.7
Georgetown County														
Men	277	198	71.5	43	15.5	36	13.0	204	121	59.3	44	21.6	39	19.1
Women	313	214	68.4	36	11.5	63	20.1	264	157	59.5	33	12.5	74	28.0
Total	590	412	69.8	79	13.4	99	16.8	468	278	59.4	77	16.4	113	24.1
All Sites Combined														
Men	2500	1970	78.8	309	12.4	221	8.8	1544	1081	70.0	244	15.8	219	14.2
Women	2821	2188	77.6	217	7.7	416	14.7	1821	1280	70.3	176	9.7	365	20.0
Total	5321	4158	78.1	526	9.9	637	12.0	3365	2361	70.2	420	12.5	584	17.4

[a] Number of people with complete data; total N does not equal N summed for men and women because of missing values on sex.

No clear sex differences are apparent; in some sites, more men are overweight and in some, more women are overweight. The percentage of people who are at all overweight based on MSE data averages 30 in all sites combined and ranges from 26 in both Dayton and Seattle to 41 in Georgetown County. The percentage of people who are severely overweight (based on MHQ data) averages 12 percent in all sites combined and ranges from 9 to 17 percent. When MSE data are used, the percentage of severely overweight people averages 17 and ranges from 13 to 24.

More women than men are severely overweight in all sites; an average of 15 percent of women and 9 percent of men are severely overweight using MHQ data; using MSE data, an average of 20 percent of women and 14 percent of men are severely overweight.

Equivalence of Experimental Groups on the Overweight Measure

For purposes of testing experimental hypotheses, it is essential for the experimental groups to be equivalently distributed on the important outcome measures. For purposes of this test, we grouped insurance plans into the following four categories (see the Preface for more details regarding plans):

Category	Number	Type
Free	1	Free plan
25% and 50% coinsurance	3	25% coinsurance plan
	1	50% coinsurance plan
95% coinsurance	3	95% coinsurance plan
Individual deductible	1	95% coinsurance to a maximum of $150 per individual per year

Table 30 shows the distribution of the percentage who are overweight at all (either moderately or severely), the percentage who are severely overweight, and the mean W/H^p (for people who are moderately or severely overweight) by these four categories of insurance plan for data from all sites combined. We found no evidence of an association between the plan and these measures.

The group health experimental (GHE) plan was also of interest in this test of equivalence. However, because this plan only occurs in Seattle, it is confounded with site differences. Thus, we performed a separate test in Seattle of GHE in comparison with all the other four types of plans. This analysis yielded nonsignificant chi squares with 10 percent of the people being severely overweight in both comparison groups (GHE and the other plans) and 18 percent of the people being overweight at all in both comparison groups. There were no significant differences in the mean W/H^p in Seattle in overweight people.

Table 30

PERCENTAGE OF OVERWEIGHT PEOPLE BY INSURANCE PLAN CATEGORIES: ALL SITES COMBINED

Plan	Percent Who Are Overweight[a]	Percent Who Are Severely Overweight	Mean W/H^p of Overweight[a] People
Free	22.9	12.4	1.43
25% and 50% coinsurance	21.9	11.3	1.47
95% coinsurance	21.5	11.6	1.43
Individual deductible	21.9	12.2	1.49
Test-statistic	χ^2 = .49 (N.S.[b])	χ^2 = .58 (N.S.)	F = .22 (N.S.)

[a] Percent of people in each category of plan who are either moderately or severely overweight.

[b] Not significant.

VI. RELIABILITY AND VALIDITY OF THE HEALTH INSURANCE STUDY MEASURES OF WEIGHT AND OVERWEIGHT

Because some of the reliability and validity analyses were closely related, we will discuss these two issues together. Information in this section covers

1. Test-retest reliability of the measures of weight and height obtained at the MSE.
2. The occurrence of digit preference in self-reported weight and height.
3. Reliability and validity of the self-reported weight and height measures from the MHQ in relation to the measures obtained at the MSE.
4. Comparison of HIS data on weight, height, and the prevalence of overweight with similar data obtained on a national probability sample.
5. Evaluation of the types of approaches taken to reduce as a function of being under a doctor's care.
6. Evaluation of the likelihood of being under a doctor's care as a function of the severity of overweight.
7. Evaluation of the effects of being overweight (e.g., restricted activity) as a function of the severity of overweight.
8. Comparison of the subjective measure of overweight based on self-evaluation and the HIS criterion-based measure.
9. Studies of the associations among the measures of weight.

MEDICAL SCREENING EXAMINATION: TEST-RETEST RELIABILITY

An indication of the reliability of the measures of weight and height obtained during the MSE is provided by test-retest reliability coefficients. We tested three types of repeat measures:

Measures Being Correlated	Time Difference
1. Initial measure (1a) with immediate repeat of initial measure (1b)[a]	Immediate
2. Repeat measure (2a) with immediate repeat of repeat measure (2b)[a]	Immediate
3. Average of initial measures with average of repeat measures (the repeat measures were performed without knowledge of the initial measures)	Two hours

[a] See page 57 for a discussion of these measures.

Table 31 gives a summary of these coefficients for all sites. All coefficients were at least 0.99, except one that was low because of bad data on one person only. Thus, the measures of both height and weight obtained at the MSE were extremely reliable.

MEDICAL HISTORY QUESTIONNAIRE: DIGIT PREFERENCE

There was a tendency for people to report their weight (in pounds) in numbers ending in 0 and 5 (e.g., 100, 125). For all sites combined, 66 percent of the respondents reported weights ending in digits 0 or 5 (weights ranged from 70 to 350 pounds). No such tendency was observed for the height measure. We evaluate this digit preference below with respect to whether it affects validity or reliability or both.

COMPARISON OF SELF-REPORTED WITH ACTUAL WEIGHT AND HEIGHT

Weight and height were obtained by self-report on the MHQ; they were also obtained by technicians during the MSE for a randomly selected subsample of people completing the MHQ. We described the procedures used to obtain these measures earlier. The time lapse between the MHQ and the MSE was one month or less for 95 percent of the people; the maximum time difference was about three months; only 1 percent had time differences of greater than two months.

By considering the value of weight and height obtained at the MSE as the true value, we used the following measurement model to test the reliability and validity of self-reported weight and height:[1]

$$\text{Self-reported (MHQ) value} = \text{true (MSE) value} + \text{error} .$$

We calculated the error in the model as the self-reported (MHQ) value minus the true (MSE) value.

We assessed validity in two ways: (1) the criterion validity of the self-reported value—the correlation of the self-reported value with the true (criterion) value; and (2) the mean of the error score. By testing whether the errors (i.e., the difference between the self-reported value and the true value) have a nonzero mean, we can determine whether there is bias in the population (which could be a threat to validity). In addition, we can compare specified groups of people on the mean of the error score to determine if one group has more reporting bias than the other (e.g., men versus women).

We estimated the reliability of the self-reported values as the variance of the error scores. This is a nontraditional indicator of reliability because one rarely has a "true score" (and thus an error score) available. Although the magnitude of the variance of the error scores for the total sample is difficult to evaluate in terms of reliability (i.e., no criteria for low or high reliability are known), we can compare specified groups on their variance to see if one group has less reliable self-reported values than the other (e.g., lower versus higher education).

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[1] For more detailed information on this measurement model, see Stewart, 1980.

Table 31

TEST-RETEST RELIABILITY COEFFICIENTS FOR WEIGHT AND HEIGHT MEASURED AT THE MEDICAL SCREENING EXAMINATION

	Weight						Height					
	Initial Measures 1a and 1b (Immediate)		Repeat Measures 2a and 2b (Immediate)		Average of Initial and Average of Repeat (2 hours)		Initial Measures 1a and 1b (Immediate)		Repeat Measures 2a and 2b (Immediate)		Average of Initial and Average of Repeat (2 hours)	
Site	N[a]	r[b]	N	r	N	r	N	r	N	r	N	r
Dayton	626	.99[c]	19	.99	18	.99	626	.99	23	.99	21	.99
Seattle	1043	.99	29	.99	18	.99	1043	.99	31	.99	21	.98
Fitchburg	358	.99	11	.99	6	.99	358	.99	11	.99	6	.99
Franklin County	451	.99	10	.99	10	.99	451	.99	10	.99	10	(.43)[d]
Charleston	422	.99	18	.99	10	.99	424	.99	18	.99	10	1.00
Georgetown County	467	.99	10	.99	10	.99	467	.99	10	.99	10	.99
All sites combined	3367	.99	97	.99	72	.99	3369	.99	103	.99	78	.92

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[a] Number of people with complete data.

[b] Pearson product-moment correlation.

[c] All correlations are significant ($p < .01$) except the one in parentheses.

[d] This low correlation was due to one person for whom repeat height was 10 inches greater than initial height.

Potential Sources of Error and Bias

There are many factors that could contribute to the occurrence of both random error and bias. Coding errors (e.g., inadvertent recording of 212 instead of 112 pounds) would be expected to contribute to random error. Digit preference (e.g., tendency to report weight ending in zero or five) would contribute to random error if people tend to round to the nearest preferred digit; it would contribute to bias if people tend to round down. People may tend to underreport weight (i.e., to appear thin) or to overreport height (i.e., to appear tall), both of which contribute to bias. People who worry about their weight may be more reliable in reporting weight because they weigh themselves more frequently, but less valid (i.e., biased) because they may want to appear to weigh less and thus underreport their weight. Poorer people may be less reliable in reporting weight because they have less access to scales and therefore less knowledge of their weight.

Coding Errors

Preliminary evaluation of the distribution of error scores suggested that data coding errors were probably present (e.g., weight difference scores around −100 and +200). To eliminate such coding errors, we excluded from the analyses all people with an *error* score (self-reported − true value) of ±4 standard deviations from the mean error score for height or weight. We chose this value because in the sample of 3373 people included in this analysis, assuming a normal distribution of errors, no people would be expected to fall outside of this range by chance alone; thus, theoretically only people with coding errors would be excluded. Although this procedure does not eliminate all coding errors, it does exclude the extreme ones that most affect the variance of the error scores. For weight, we eliminated 37 cases (1 percent) and for height, 20 cases.

Weight

Table 32 gives a summary of information and tests regarding the reliability and validity of self-reported measures of weight. To test whether there were differences in mean error scores between two groups, we performed a t-test on the mean error score. When more than two groups were compared, we made an analysis of variance. Test statistics associated with chance probabilities of 0.05 or less for Type I errors were considered significant.

We compared the variances of the error scores between specified groups to identify differences in reliability between these groups. We used Bartlett's test (1937) for homogeneity of variance, corrected for the kurtosis of the distribution using Box's (1953) correction.

Validity. Overall, people tended to report weighing slightly less than they actually do (mean is 2.4 pounds less). The 99-percent confidence interval for the population mean of the error scores is −2.1 to −2.6 pounds. Thus, we can reject the hypothesis that the mean error is zero. The validity coefficient was exceedingly high for the total sample ($r = 0.99$), as well as for all groups. The only groups in which the validity coefficient was less than 0.96 were the various weight category groups (i.e., categories of actual weight), and this occurred because the restricted range of weight in each of these groups attenuated the correlation coefficient.

Table 32

SUMMARY OF INFORMATION AND TESTS REGARDING THE RELIABILITY AND VALIDITY OF SELF-REPORTED WEIGHT

		Error Score[a]			Test for Group Differences		
Test Sample	N[b]	Mean	Standard Error of the Mean	Variance	Mean Errors[c] (Validity)	Variance of Errors[d] (Reliability)	Validity Coefficient[e]
Total Sample	3226	-2.4	.1	30.09	--	--	.99
Men vs. Women							
Men	1494	-1.6	.1	28.4	7.78†	1.68	.98
Women	1725	-3.1	.1	32.0			.98
Education[f] (yr)							
Men							
2-9	166	-0.9	.4	31.2	6.55†	1.33	.98
10-12	552	-1.3	.2	28.8			.98
Over 12	532	-2.2	.2	24.9			.98
Women							
2-9	157	-3.9	.7	69.2	2.05	33.77†	.98
10-12	788	-3.0	.2	31.8			.98
Over 12	541	-2.6	.2	19.8			.99
Age (yr)							
14-17	428	-2.4	.3	32.4	-0.24	.16	.97
18-61	2798	-2.4	.1	30.7			.99
14-17	428	-2.4	.3	32.4	2.90*	4.21	.97
18-29	1039	-2.0	.2	32.2			.98
30-39	812	-2.7	.2	30.9			.99
40-49	460	-2.8	.3	33.1			.99
50-61	487	-2.3	.2	24.6			.99
Weight (actual) (lb)							
Men							
137 or less	216	0.8	.4	26.7	32.28†	6.79	.99[g]
138-169	567	-0.9	.2	24.4			.86
170-201	502	-2.6	.2	23.9			.86
202+	209	-3.5	.4	39.3			.96
Women							
108 or less	164	-0.1	.3	11.5	59.29†	106.39†	.84[g]
109-142	910	-2.1	.1	15.3			.91
143-175	426	-4.4	.3	40.7			.80
176+	225	-6.7	.6	71.9			.95
People Who Believe They Are Overweight[h] vs. Those Who Do Not							
Total Sample							
Overweight	1331	-3.6	.2	31.1	11.09†	.62	.99
Not overweight	1891	-1.5	.1	28.9			.98
Men							
Overweight	447	-3.2	.2	27.7	7.80†	.02	.98
Not overweight	1045	-0.9	.2	27.2			.98
Women							
Overweight	882	-3.9	.2	32.7	6.10†	.47	.98
Not overweight	841	-2.2	.2	30.0			.96

Table 32—continued

Test Sample	N^b	Error Score[a]			Test for Group Differences		Validity Coefficient[e]
		Mean	Standard Error of the Mean	Variance	Mean Errors[c] (Validity)	Variance of Errors[d] (Reliability)	
Overweight People[h] Trying To Lose Weight vs. Those Not Trying							
Total Sample							
Trying to lose weight	541	-3.7	.2	30.6	0.46	.01	.99
Not trying to lose weight	770	-3.6	.2	31.0			.99
Men							
Trying to lose weight	131	-3.5	.5	27.8	0.89	.00	.98
Not trying to lose weight	315	-3.0	.3	27.7			.98
Women							
Trying to lose weight	410	-3.8	.3	31.5	-0.46	.08	.98
Not trying to lose weight	453	-4.0	.3	33.1			.98
Overweight People[h] Who Worry about Their Weight vs. Those Who Do Not							
Total Sample							
Worry	575	-4.3	.2	33.8	3.66†	1.35	.99
Don't worry	754	-3.2	.2	28.6			.99
Men							
Worry	118	-4.3	.5	31.8	2.60†	.57	.98
Don't worry	327	-2.8	.3	25.8			.98
Women							
Worry	456	-4.3	.3	34.4	2.25†	.42	.99
Don't worry	426	-3.4	.3	30.7			.98
Overweight People[h] Who Are under a Doctor's Care To Lose Weight vs. Those Who Are Not							
Total Sample							
Under doctor's care	75	-3.5	.8	48.6	-0.18	2.74	.98
Not under doctor's care	1254	-3.7	.2	30.1			.99
Men							
Under doctor's care	21	-2.8	1.2	30.5	-0.23	.03	.99
Not under doctor's care	426	-3.2	.2	27.6			.98
Women							
Under doctor's care	54	-3.8	1.0	56.1	-0.13	2.99	.98
Not under doctor's care	826	-3.9	.2	31.3			.98

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*$p < .05$.

†$p < .01$.

[a] Self-reported (MHQ) weight less actual (MSE) weight.

[b] Number of people with complete data.

[c] t-statistic for two groups; F-test (i.e., analysis of variance) for more than two groups.

[d] Bartlett's M_1 corrected for kurtosis, distributed as χ^2 with k - 1 degree of freedom (see Box, 1953).

[e] Product-moment correlation between actual weight and self-reported weight.

[f] The analyses on education are restricted to people aged 18 and older.

[g] These coefficients are attenuated because the groups represent a restricted range of weight.

[h] People who either believe they are overweight or have been told by a doctor or nurse that they are overweight.

Women tended to underestimate their weight more than men (mean underestimate of 3.1 pounds for women compared with 1.6 pounds for men). For men, as education increased the extent of underreporting of weight increased ($r = -0.11$, $p < .01$). For women, we observed the reverse pattern: as education decreased, the extent of underreporting increased ($r = 0.08$, $p < .01$). We can partially explain this finding by the association between education and weight because the error score is correlated with actual weight. Among men, education is positively associated with actual weight ($r = 0.13$, $p < .001$) and among women, education is negatively associated with actual weight ($r = -0.12$, $p < .001$).

No linear correlation was observed between age and the error score. When we compared adults (18 to 61) with adolescents (14 to 17), we observed no differences in bias. However, when age was categorized in approximate decades, we observed some group differences. The extent of underreporting was greater in people aged 30 to 49 (around three pounds) than in the other age groups (about two pounds).

For both men and women, the extent of underreporting increased as actual weight increased; this trend was more apparent for women than for men. For men, the correlation between actual weight and the error score was -0.27 ($p < .01$) and for women, -0.34 ($p < .01$).

People who believe they are overweight tended to underestimate their weight more (mean underestimate of 3.6 pounds) than people who do not believe they are overweight (mean underestimate of 1.5 pounds). This may be explained to some extent by the association between the error score and actual weight. Overweight people[2] who worry about their weight underestimated their weight to a greater extent (mean underestimate of 4.3 pounds) than those who do not worry (mean underestimate of 3.2 pounds) ($p < .01$). We observed no differences in the amount of underreporting as a function of whether the overweight person was trying to lose weight, or whether the overweight person was under a doctor's care to lose weight.

Reliability. We found no differences in reliability of self-reported weight as a function of sex, age, whether people believe they are overweight, and whether overweight people[2] are trying to lose weight or worry about their weight or are under a doctor's care to lose weight.

Among men, we observed no differences in reliability as a function of education or actual weight. Among women reliability decreased directly as education decreased and as actual weight increased.

Digit Preference. We noted a strong digit preference in self-reported weight. Thus, analyses were designed to evaluate whether such preference represented a threat to reliability or validity or both.

We evaluated the mean and variance of the error scores and the validity coefficients for four groups of people based on the last digit of reported weight: (1) zero; (2) five; (3) either zero or five; and (4) neither zero nor five (i.e., no digit preference). We compared the mean error score and the validity coefficient of each of the three preference groups with the mean error score and the validity coefficient of the no preference group to determine if the validity of self-reported weight differed between these groups. If people with a digit preference are simply rounding to the nearest zero or five, no differences in mean error scores would be ex-

[2] People who either believe they are overweight or have been told by a doctor or a nurse that they are overweight.

pected. If they are rounding down, mean scores would be expected to be lower for the preference groups than for the no preference group.

We compared the variances of the error scores between each of the three preference groups and the no preference group to determine if the reliability of self-reported weight differed between the groups.

These tests represent conservative estimates of differences in reliability and validity as a function of digit preference because the 10 percent of people who legitimately report their weight ending in zero or five are included in the digit-preference groups.

Table 33 gives a summary of information regarding the reliability and validity of self-reported weight for groups with various digit preferences. People who respond with a zero-digit preference have more bias in their self-reported weight score than those with no preference (mean error score of −2.9 compared with −1.9). Those who respond with a five-digit preference do not have significantly more bias than those with no preference. Thus, it appears that people who respond with a zero preference are rounding down, whereas people who respond with a five preference are rounding to the nearest five. The validity coefficient, however, was nearly identical for all groups (all above 0.98).

The reliability of self-reported weight was poorer for all groups exhibiting a digit preference than for the group with no digit preference.

The various digit-preference groups were evaluated as a function of sex, education, age, and whether or not people believe they are overweight. We summarize these results in Table 34. Men were more likely than women to exhibit digit preference of both kinds (71 percent of men and 56 percent of women had some digit preference). People over 18 were slightly more likely to exhibit digit preference than people 14 to 17 (64 percent of adults and 57 percent of adolescents had some digit preference). We observed no differences in digit preference as a function of education or whether people believed they were overweight.

Estimating Actual Weight. It may be desirable in some studies to estimate actual weight based on self-reported weight and the other factors that are known to affect the error. Given the large sample size in this study, and the general representativeness of this sample to people in the United States, an equation estimating actual weight in this sample might be useful to other investigators who wish to estimate actual weight.

We performed an ordinary least squares regression analysis to estimate actual weight as a function of self-reported weight and other factors that were found (in the above univariate analyses) to affect the error. We used the general linear model (GLM) program in SAS (SAS Institute, 1979) for this purpose. Regressions were performed separately for men and women, because the correlation between education and weight was different for men than for women.

We began the regression analyses by trying to estimate actual weight as a function of self-reported weight, zero-digit preference, five-digit preference, age, education, age squared, whether the person believed he or she was overweight, and an age by education interaction term. This interaction term was included to determine if we needed to exclude people under 18 from the analyses regarding education. Of these predictors, we excluded age, age squared, and the age by education interaction term from the final analysis because they did not explain a significant amount of variance in any sample. Table 35 presents a summary of the multiple

Table 33

SUMMARY OF INFORMATION AND TESTS REGARDING THE RELIABILITY AND VALIDITY OF SELF-REPORTED WEIGHT AS A FUNCTION OF DIGIT PREFERENCE

		Error Score[a]			Test of Group Differences[b]		
Test Sample	N[c]	Mean	Standard Error of the Mean	Variance	Mean Errors[d] (Validity)	Variance of Errors[e] (Reliability)	Validity Coefficient[f]
Last digit zero	1066	-2.9	.2	39.5	4.39†	30.17†	.98
Last digit five	970	-2.3	.2	32.4	1.82	13.08†	.98
Last digit zero or five	2036	-2.6	.1	36.2	3.89†	28.05†	.98
No preference (last digit other than zero or five)	1190	-1.9	.1	21.6	--	--	.99

† $p < .01$.

[a] Self-reported (MHQ) weight less actual (MSE) weight.

[b] Comparison of digit-preference group to no-preference group.

[c] Number of people with complete data.

[d] t-test.

[e] Bartlett's M_1 corrected for kurtosis, distributed as χ^2 with k - 1 degree of freedom (see Box, 1953).

[f] Product-moment correlation between actual weight and self-reported weight (all coefficients significant, $p < .001$).

Table 34

CHI-SQUARE STATISTICS FOR DIGIT-PREFERENCE GROUPS AS A FUNCTION OF DEMOGRAPHIC AND OTHER CHARACTERISTICS

Characteristic	Zero Preference versus No Preference	Five Preference versus No Preference	Any Preference versus No Preference
Sex[a]	56.0†	69.5†	84.4†
Education[b]	1.4	4.8	3.4
Age[c] (adults vs. adolescents)	4.1*	8.4†	8.5†
Age[d] (age groups)	8.7	26.5†	21.4†
Overweight[e]	<1.0	<1.0	<1.0

*$p < .05$.

†$p < .01$.

[a] More men have digit preference.

[b] 1 = 2 to 9 years; 2 = 10 to 12 years; 3 = over 12 years.

[c] 1 = 14 to 17; 2 = 18 and older; more people over 18 have digit preference.

[d] 1 = 14 to 17; 2 = 18 to 29; 3 = 30 to 39; 4 = 40 to 49; 5 = 50+; more people aged 18 to 29 have digit preference.

[e] 1 = people who believe they are overweight; 2 = people who do not believe they are overweight.

regression analysis to estimate actual weight. The amount of variance in actual weight predicted by the equation was 0.97 for both men and women.

To allow other investigators to estimate actual weight, we calculated a second regression equation based on adults only (18 to 61), excluding the variable pertaining to whether people believe they are overweight. This second equation is intended to be useful in studies (other than the HIS) that are restricted to adults and that are not apt to include data on beliefs about being overweight. The amount of variance in actual weight predicted by this equation is again 0.97 for both men and women.

Height

A summary of information and tests regarding the reliability and validity of self-reported measures of height is presented in Table 36.

Validity. Overall, people tend to report being slightly taller than they actually are (mean is 0.6 inches taller). The 99-percent confidence interval for the population mean of the error score is 0.56 to 0.67 inches. Thus, we can reject the hypothesis that the mean error is zero. The validity coefficient was very high for the total sample ($r = 0.97$).

Men overreport their height to a greater extent than women. Among men, the extent of overreporting is not associated with education. Among women, as educa-

Table 35

Coefficients To Estimate Actual Weight for Two Groups of People: Age 14 to 61 and Age 18 to 61 (Adults)

Predictor	Age 14 to 61				Age 18 to 61 (Adults)			
	Men (N=1333)		Women (N=1573)		Men (N=1250)		Women (N=1486)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	-[illegible].2144		1.7024		-4.8250		.3598	
Self-reported weight	1.0012	170.29	1.0154	186.05	1.0230	190.89	1.0235	216.42
Education[a]	.1267	2.83	-.1725	-3.24	.1715	3.65	-.1173	-2.17
Zero-digit preference[b]	.5910	1.69	1.6324	4.91	.6068	1.63	1.7575	5.17
Five-digit preference[c]	.2414	.68	.9722	2.81	.1699	.45	.9921	2.81
Believe they are overweight[d]	2.2208	6.23	1.1179	3.43	(e)	(e)	(e)	(e)
R^2	.97		.97		.97		.97	
F-value	8655.54		9887.30		9204.76		12,255.94	

[a] Number of school years completed.

[b] 0 = no zero-digit preference; 1 = zero-digit preference.

[c] 0 = no five-digit preference; 1 = five-digit preference.

[d] 1 = people who either believe they are overweight or have been told by a doctor or nurse that they are overweight; 0 = do not so believe.

[e] Not included in this analysis (see text).

Table 36

SUMMARY OF INFORMATION AND TESTS REGARDING THE RELIABILITY AND VALIDITY OF SELF-REPORTED HEIGHT

		Error Score[a]			Test for Group Differences		
Test Sample	N[b]	Mean	Standard Error of the Mean	Variance	Mean Errors[c] (Validity)	Variance of Errors[d] (Reliability)	Validity Coefficient[e]
Total Sample	3211	.61	.02	.95	--	--	.97
Men vs. Women							
Men	1474	.82	.02	.91	11.84[†]	0.00	.94
Women	1730	.42	.02	.91			.93
Education[f] (yr)							
Men							
2-9	165	.85	.09	1.40	1.60	28.36[†]	.88
10-12	550	.94	.04	.87			.93
Over 12	529	.85	.03	.59			.96
Women							
2-9	151	.75	.11	1.84	14.61[†]	44.33[†]	.84
10-12	788	.47	.03	.88			.93
Over 12	553	.30	.03	.61			.95
Age (yr)							
14-17	413	.34	.05	1.15	-5.92[†]	5.38[*]	.95
18-61	2798	.65	.02	.91			.97
14-17	413	.34	.05	1.15	14.62[†]	9.05	.95
18-29	1048	.58	.03	.86			.97
30-39	819	.60	.03	.87			.97
40-49	452	.75	.04	.95			.96
50-61	479	.79	.04	1.01			.96
Height (actual) (in.)							
Men							
65 or less	148	.85	.09	1.32	0.91	18.67[†]	.69
66-68	536	.86	.04	1.06			.61
69-71	567	.81	.04	.76			.68
72+	223	.74	.05	.67			.81
Women							
60 or less	308	.72	.06	1.30	12.67[†]	22.85[†]	.68
61-63	508	.38	.04	.84			.44
64-66	688	.36	.04	.86			.65
67+	226	.29	.05	.58			.85
People Who Believe They Are Overweight[g] vs. Those Who Do Not							
Total Sample							
Overweight	1348	.55	.02	.82	2.73[†]	12.15[†]	.97
Not overweight	1859	.65	.02	1.05			.96
Men							
Overweight	440	.85	.04	.77	-0.65	4.46[*]	.94
Not overweight	1032	.81	.03	.98			.94
Women							
Overweight	906	.41	.03	.78	0.51	11.11[†]	.94
Not overweight	822	.44	.04	1.07			.92

[*] $p < .05$.

[†] $p < .01$.

[a] Self-reported (MHQ) height less actual (MSE) height.

[b] Number of people with complete data.

[c] t-statistic for two groups; F-test (i.e., analysis of variance) for more than two groups.

[d] Bartlett's M_1 corrected for kurtosis, distributed as χ^2 with k - 1 degree of freedom (see Box, 1953).

[e] Product-moment correlation between actual height and self-reported height.

[f] The analyses on education are restricted to people aged 18 to 61.

[g] People who either believe they are overweight or have been told by a doctor or nurse that they are overweight.

tional level decreased, they overreported their height to a greater extent ($r = -0.13$, $p < .01$). Age was positively correlated with the error score ($r = 0.13$, $p < .01$); as age increased, the error score increased.

People aged 18 to 61 overreported their height to a greater extent than people aged 14 to 17. When age was categorized into approximate decades, the extent of overreporting appeared to increase as age increased (the overall F-test was significant; the trend was not tested). Among men, the mean error score was unrelated to actual height. Among women, however, the amount of overreporting was greatest among those in the lowest height category, and lowest in the highest height category. People who did not believe they were overweight overreported their height to a greater extent than those who did; however, when we evaluated men and women separately, this finding was not significant.

Reliability. No differences in reliability were observed as a function of sex. Reliability decreased as educational level decreased for both men and women. Adolescents (age 14 to 17) had poorer reliability than adults (age 18 to 61). When we categorized age in approximate decades, we observed no differences in reliability as a function of age. As actual height decreased, the reliability decreased for men. Among women, the highest reliability occurred in the tallest height category, and the lowest reliability in the shortest height category. People who believed they were overweight were more reliable in reporting their height than people who did not believe they were overweight.

Estimating Actual Height. Table 37 gives a summary of the multiple regression analyses, performed separately for men and women, to estimate actual height. The amount of variance in actual height predicted by the equation was 0.88 for men and 0.87 for women. We list separate equations for adults (18 to 61) to facilitate use of these data by other investigators.

Conclusions Regarding the Reliability and Validity of Self-Reported Weight and Height

The overall impression obtained from these analyses is that self-reported weight and height are remarkably accurate indicators of actual weight and height. These measures were valid and reliable even in groups of people in which one might expect poorer quality data (e.g., those who are severely overweight, those with less education). Although some bias occurred, the magnitude of the bias was small. We observed an average underreporting of 2.4 pounds and an average overreporting of 0.6 inches. The validity coefficient was 0.99 for self-reported weight and 0.97 for self-reported height.

There were some group differences in validity and reliability. However, even for those groups exhibiting the most bias, the magnitude was still not very large. The most extreme bias was an underreporting of only about seven pounds (this occurred in overweight women) and an overreporting of 0.94 inches (in men with 10-12 years of education).

We can possibly explain the net underreporting of 2.4 pounds because of differences in method. For example, the MHQ asked for weight "without heavy clothes," and at the MSE, people were weighed in their street clothes without shoes. Further, almost all MSE data were collected in the afternoon, whereas probably most people weigh themselves in the morning. Thus, it is possible that there is no underreport-

Table 37

COEFFICIENTS TO ESTIMATE ACTUAL HEIGHT FOR TWO GROUPS OF PEOPLE: AGE 14 TO 61 AND AGE 18 TO 61 (ADULTS)

	Age 14 to 61				Age 18 to 61 (Adults)			
	Men (N=1328)		Women (N=1583)		Men (N=1244)		Women (N=1492)	
Predictor	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	6.3036		5.1364		5.7327		4.9200	
Self-reported height	.8986	96.32	.9071	101.19	.9034	93.07	.9107	98.67
Education[a]	.0115	1.36	.0553	5.97	.0258	3.19	.0536	5.89
Age	-.0068	-3.33	-.0086	-4.45	-.0058	-2.68	-.0084	-4.12
Age, by education[b]	.0018	2.65	-.0004	-.52	(c)	(c)	(c)	(c)
R^2	.88		.87		.88		.87	
F-value	2500.95		2675.14		3110.34		3388.69	

[a] Years of school completed.

[b] Age times education.

[c] Not included in this analysis.

ing as such; that is, if the methods were precisely controlled, the net bias would be zero.

There are fewer plausible explanations for the net overreporting of height. Nevertheless, the magnitude of the bias is very small.

It is possible that both bias and error in self-reported values could be further reduced through the use of better instructions to respondents. For example, digit preference could probably be reduced by asking respondents to report their weight to the nearest pound, that is, specifically requesting that they not round off.

COMPARISON OF HIS DATA ON WEIGHT, HEIGHT, AND OVERWEIGHT WITH NATIONAL DATA

We compared the HIS data on height, weight, and overweight from both the MHQ and the MSE to similar data obtained on a national probability sample from the HANES (USDHEW, 1979a and 1979b) by sex and for various age groups. Data were not available from the HANES for people under age 18. Table 38 presents the results.

Weight

The national HANES data and HIS data on weights were comparable. The median discrepancy between national data and MHQ data was one pound for the 11 age and sex groups. The median discrepancy between national data and MSE data was four pounds, with MSE weight higher in most groups. We expected this result because MSE weight was taken in street clothes whereas national HANES weight was taken in disposable gowns.

Height

Heights were also quite comparable. The median discrepancy between the HANES data and MHQ data was 0.5 inch, with MHQ heights always being higher. The median discrepancy between the HANES data and MSE data was 0.3 inch, with HANES heights being higher in most groups.

Overweight

The prevalence of overweight as estimated using MSE data was roughly comparable to that estimated using national HANES data. Prevalence estimates using self-reported MHQ data were lower for all age groups than those using national data.

APPROACHES TAKEN TO REDUCE AS A FUNCTION OF BEING UNDER A DOCTOR'S CARE

We were interested in whether people take different approaches to reduce if they are under a doctor's care to lose weight than if they are not. A summary of results of this analysis is presented in Table 39. For overweight people who are under a doctor's care, the most common approach to reduce is to diet (about 91

Table 38

MEAN WEIGHT AND HEIGHT AND PREVALENCE OF OVERWEIGHT BY SEX AND AGE: COMPARISON OF NATIONAL DATA WITH HEALTH INSURANCE STUDY ENROLLMENT DATA

	1971-1974 National HANES Data (Actual Measures)[a] (N=13,671)				1974-1977 HIS Medical History Questionnaire Data (Self-Reported)[b] (N=4703)				1974-1977 HIS Medical Screening Examination Data (Actual Measures)[c] (N=2897)			
Sex/Age	N	Mean Weight in Pounds	Mean Height in Inches	% Overweight[d] (RRWN≥120)	N	Mean Weight in Pounds	Mean Height in Inches	% Overweight[d] (RRWN≥120)	N	Mean Weight in Pounds	Mean Height in Inches	% Overweight[d] (RRWN≥120)
Men												
18-74	5260	172	69.0	14.0	2158	174	70.0	9.5	1315	175	69.0	13.8
18-24	772	165	69.7	7.4	416	166	70.2	7.7	234	161	69.1	6.4
25-34	804	176	69.6	13.6	777	176	70.4	9.3	459	178	69.5	14.1
35-44	665	178	69.1	17.0	445	177	69.7	11.6	312	179	68.8	16.7
45-54	765	175	68.9	15.8	336	177	69.4	10.7	188	181	68.6	19.0
55-64	597	17[illegible]	68.3	15.1	170	170	69.0	6.3	116	176	68.2	15.5
65-74	1657	164	67.3	13.[illegible]	14	165	68.8	(e)	(e)	(e)	(e)	(e)
Women												
18-74	8411	143	63.6	23.8	2545	140	64.3	16.9	1582	144	63.7	21.4
18-24	1524	132	64.3	9.6	548	132	64.5	9.5	321	135	64.1	13.2
25-34	1896	140	64.1	17.1	876	137	64.3	13.0	546	140	63.9	17.3
35-44	1663	148	64.1	24.3	486	147	64.4	21.5	310	152	63.6	29.4
45-54	836	149	63.6	27.8	432	149	64.1	26.3	258	153	63.3	30.6
55-64	670	149	62.8	34.7	200	144	63.7	19.4	146	149	63.1	28.1
65-74	1822	146	62.3	31.5	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)

---

[a] Health and Nutrition Examination Survey (USDHEW, 1979a and 1979b); weight and height in foam slippers and disposable gowns.

[b] Weight "without heavy clothes" and height "without shoes on."

[c] Weight in street clothes but no shoes; height without shoes.

[d] Calculated for people 20 and older.

[e] Too few cases to calculate statistics.

Table 39

TYPES OF APPROACHES OVERWEIGHT PEOPLE[a] TAKE TO REDUCE AS A FUNCTION OF BEING OR NOT BEING UNDER A DOCTOR'S CARE TO LOSE WEIGHT (Enrollment Medical History Questionnaire)

	Total Overweight People[a]		Overweight People[a] under a Doctor's Care		Overweight People[a] Not under a Doctor's Care	
Approaches Taken	Number	Percent	Number	Percent[b]	Number	Percent[c]
Combinations of Approaches						
None	1286	54.4	2	1.2	1284	58.4
Diet only	321	13.6	68	42.5	253	11.5
Exercise only	254	10.7	0	0.0	254	11.5
Diet and exercise	239	10.1	12	7.5	227	10.3
Diet, exercise, and organization[d]	61	2.6	[illegible]	1.9	58	2.6
Diet and organization	49	2.1	3	1.9	46	2.1
Diet and pills	39	1.6	33	20.6	6	0.3
Exercise and organization	25	1.0	0	0.0	25	1.1
Diet, exercise, and pills	18	0.8	13	8.1	5	0.2
Organization only	15	0.6	1	0.6	14	0.6
Pills only	12	0.5	7	4.4	5	0.2
Diet, exercise, pills, and organization	9	0.4	9	5.6	0	0.0
Diet, pills, and organization	2	0.1	2	1.2	0	0.0
Exercise and pills	1	0.0	0	0.0	1	0.0
Exercise, pills, and organization	1	0.0	0	0.0	1	0.0
Pills and organization	0	0.0	0	0.0	0	0.0
Missing approach variable	28	1.2	7	4.4	21	1.0
Missing doctor's care item	3	0.1	--	--	--	--
Total[e]	2363	99.8[f]	160	99.9[f]	2200	99.8[f]
Separate Approaches						
Diet	748	31.7	146	91.2	600	27.3
Exercise	610	25.8	38	23.7	572	26.0
Pills	85	3.6	66	41.2	18	0.8
Organization	164	6.9	19	11.9	145	6.6

---

[a] People who either think they weigh too much or have been told by a doctor or nurse that they weigh too much.

[b] Percent of those under a doctor's care.

[c] Percent of those not under a doctor's care.

[d] Weight Watchers, reducing salon, exercise gym, or health spa.

[e] The number of people under a doctor's care and not under a doctor's care do not sum to the total because of missing values on the doctor's care item.

[f] Does not equal 100.0 due to rounding error.

percent), followed by taking reducing pills (about 41 percent). Overweight people who are not under a doctor's care to reduce are most likely to either diet or exercise (27 and 26 percent, respectively). Thus, as would be expected, people under a doctor's care to reduce are more likely to be taking reducing pills. This is of particular interest because use of reducing pills may be no more effective than diet and can under some circumstances be dangerous.

LIKELIHOOD OF BEING UNDER A DOCTOR'S CARE AS A FUNCTION OF THE SEVERITY OF OVERWEIGHT

Table 40 shows the percentage of people who are under a doctor's care to lose weight in each of the categories of overweight for each site and for all sites combined. Only people who believe they are overweight or have been told by a doctor that they are overweight responded to the doctor's care item. However, the percentages are calculated using the total number of people in each overweight category. There is a trend for people who believe they are overweight to be more likely to be under a doctor's care to lose weight if they are actually more severely overweight by weight measurement.

Table 40

Percentage of People[a] under a Doctor's Care To Lose Weight as a Function of the Severity of Overweight[b]

Site	N	Category of Overweight		
		Normal	Moderately Overweight	Severely Overweight
Dayton	447	5.9	14.0	19.2
Seattle	894	3.3	4.4	9.1
Fitchburg	197	7.5	6.1	8.5
Franklin County	242	2.9	0.0	6.5
Charleston	194	6.3	3.1	16.4
Georgetown County	182	4.3	11.9	5.6
All sites combined	2156	4.3	7.4	11.3

[a] People who either believe they are overweight or have been told by a doctor or nurse that they are overweight.

[b] Criterion-based measure (see text for definition).

EXTENT OF EFFECTS OF BEING OVERWEIGHT AS A FUNCTION OF THE SEVERITY OF OVERWEIGHT

Table 41 summarizes the percentage of people with any effect (as measured by pain, worry, and restricted activities caused by being overweight) for people in each

Table 41

THE EFFECTS OF OVERWEIGHT AS A FUNCTION OF THE SEVERITY OF OVERWEIGHT[a] FOR PEOPLE WHO BELIEVE THEY ARE OVERWEIGHT[b]

Effect Measure/Category of Overweight[a]	N[c]	Percent with Any Effect[d]
Pain[e]		
Normal	975	11.7
Moderately overweight	286	14.0
Severely overweight	446	35.9
Worry		
Normal	1198	90.0
Moderately overweight	392	83.9
Severely overweight	566	89.0
Restricted Activity		
Normal	1197	10.9
Moderately overweight	392	16.6
Severely overweight	567	32.1

[a] Defined in terms of the criterion-based measure.

[b] Or people who have been told by a doctor or nurse that they are overweight.

[c] Number of people in this category of overweight who responded to the impact item.

[d] Scores greater than one; any pain, worry, or restricted activity.

[e] This item was not asked in Dayton.

category of the criterion-based measure of overweight. We restricted this analysis to people who believe they are overweight or have been told by a doctor that they are overweight (i.e., only these people responded to the effect items). The amount of pain and restricted activity are positively related to the severity of overweight. The amount of worry, however, shows no relationship to the severity of overweight in this sample. This is because almost all people who believe they are overweight worry about it.

Table 42 shows the amount of effect of weight on all the people who completed the MHQ (i.e., for this analysis, respondents who both completed the MHQ and did not believe that they were overweight were assigned effect scores representing no effect). We based this assignment on the assumption that people who were told by a doctor that they were overweight and do not believe they are overweight would, if asked, logically indicate no adverse effect from their weight. In this analysis, pain, worry, and restricted activity are all positively associated with severity of overweight.

The median response to each effect item is summarized in Table 43 for the people who reported any effect on the item in question. As seen in the table, the median effect tends to be little, increasing to moderate for those people who are severely overweight. In conclusion, 26 percent of all people of normal weight nevertheless worry about their weight, while in the severely overweight group at least

Table 42

THE EFFECTS OF OVERWEIGHT AS A FUNCTION OF THE SEVERITY OF OVERWEIGHT[a] IN THE TOTAL SAMPLE

Effect Measure/Category of Overweight[a]	N[b]	Percent with Any Effect
Pain[c]		
Normal	3221	3.5
Moderately overweight	397	10.1
Severely overweight	504	31.7
Worry		
Normal	4154	26.0
Moderately overweight	525	62.7
Severely overweight	636	79.2
Restricted Activity		
Normal	4153	3.1
Moderately overweight	525	12.4
Severely overweight	637	28.6

[a] Criterion-based measure.

[b] Number of people in this category of overweight.

[c] This item was not asked in Dayton.

Table 43

MEDIAN IMPACT RESPONSE OF PEOPLE WITH ANY EFFECT OF BEING OVERWEIGHT[a] AS A FUNCTION OF THE SEVERITY OF OVERWEIGHT[b]

Impact Measure/Category of Overweight[b]	N[c]	Median Response[d]
Pain[e]		
Normal	114	2--A little
Moderately overweight	40	2--A little
Severely overweight	160	2--A little
Worry		
Normal	1078	2--A little
Moderately overweight	329	2--A little
Severely overweight	504	3--Somewhat
Restricted Activity		
Normal	130	2--A little
Moderately overweight	65	2--A little
Severely overweight	182	3--Some of the time

[a] Measured only for people who believe they are overweight or have been told by a doctor or nurse that they are overweight.

[b] Criterion-based measure.

[c] Number of people in this category of overweight who reported any effect.

[d] See Table 15 for response choices.

[e] This item was not asked in Dayton.

four-fifths worry about their weight and one-third experience pain or restricted activity.

COMPARISON OF SUBJECTIVE EVALUATION OF OVERWEIGHT AND THE HIS CRITERION-BASED MEASURE

We compared the subjective measure of whether people believed they were overweight or had been told they were overweight with the criterion-based measure of overweight (based on W/H^p—$W/H^{1.5}$ for women and W/H^2 for men). Table 44 gives cross-tabulations and measures of association between the subjective measure of overweight and the criterion-based measure of overweight. We present data for the total sample and separately for men and women.

As seen in this table, gamma coefficients were high and product-moment coefficients moderate for all samples. It should be noted that with such large sample sizes, the product-moment correlations are highly significant, yet only 17 to 25 percent of the variance in the objective measure is accounted for by the subjective measure.

Table 44

CROSS-TABULATIONS AND MEASURES OF ASSOCIATION BETWEEN THE SUBJECTIVE AND THE CRITERION-BASED MEASURE OF OVERWEIGHT

Sample	Self-Evaluation of Overweight[a]		Criterion-Based Measure of Overweight: Normal	Moderately Overweight	Severely Overweight	Total	Measure of Association: Gamma	Product-Moment
Total Sample							-.83†	-.45†
	Overweight	N	1198	393	566	2157		
		Row %	56	18	26	100		
		Col. %	29	75	89	--		
		% of total	22	[illegible]	11	41		
	Not overweight	N	2956	133	70	3159		
		Row %	94	4	2	100		
		Col. %	71	25	11	--		
		% of total	56	2	1	59		
Men							-.84†	-.50†
	Overweight	N	339	208	183	730		
		Row %	46	28	25	100		
		Col. %	17	67	83	--		
		% of total	14	8	7	29		
	Not overweight	N	1629	101	38	1768		
		Row %	92	6	2	100		
		Col. %	83	33	17	--		
		% of total	65	4	2	71		
Women							-.85†	-.41†
	Overweight	N	859	185	383	1427		
		Row %	60	13	27	100		
		Col. %	39	85	92	--		
		% of total	30	7	14	51		
	Not overweight	N	1327	32	32	1391		
		Row %	95	2	2	100		
		Col. %	61	15	8	--		
		% of total	47	1	1	49		

† $p < .01$.

[a] People who either believe they are overweight or have been told by a doctor or nurse that they are overweight.

Table 45 summarizes the sensitivity, specificity, and predictive validity of the subjective measure of overweight for men and women as well as for the total sample. The sensitivity and predictive negative validity are high. However, the predictive positive validity and specificity are low indicating that many people believe they are overweight but are not classified as overweight by means of the criterion-based measure. In particular, in the total sample 8 out of 10 people who are overweight will report being so. Of the people who report they are overweight, however, only 4 out of 10 will be overweight, but of those not reporting themselves as overweight, 9 out of 10 will be of normal weight.

Table 45

SUMMARY OF THE SENSITIVITY, SPECIFICITY, AND PREDICTIVE VALIDITY OF THE SUBJECTIVE MEASURE OF OVERWEIGHT COMPARED WITH THE CRITERION-BASED MEASURE OF OVERWEIGHT

Measure	Men	Women	Total Sample
Sensitivity[a]	73.8	89.9	82.5
Specificity[b]	82.8	60.7	71.2
Predictive positive validity[c]	53.6	39.8	44.4
Predictive negative validity[d]	92.1	95.4	93.6

[a] Percentage of those who are overweight and who believe they are overweight.

[b] Percentage of those who are not overweight and who do not believe they are overweight.

[c] Percentage of those who believe they are overweight and who are overweight.

[d] Percentage of those who do not believe they are overweight and who are not overweight.

Based on these two measures of overweight (subjective belief and the criterion-based measure), we constructed a discrepancy measure. The four possible patterns, the percentage of people responding according to each pattern, and the mean standardized W/H^p is as follows:

Pattern Number	Overweight by Criterion-Based Measure	Believe They Are Overweight	Percent of Population	Mean Standardized W/H^p
1	Yes	Yes	18	1.5
2	Yes	No	4	1.2
3	No	Yes	22	0.0
4	No	No	56	-0.6

If a discrepancy occurs (pattern numbers 2 or 3), it is more likely that the person believes he or she is overweight but is not defined as overweight by the criterion-based measure. This finding indicates that people's own standards of overweight are more stringent than the criterion of overweight used in this study. The ones chosen in this study represent the lowest values at which an effect of weight on health may be demonstrated. Thus, many people appear to be using a standard for their own weight that is more strict than that required for good health. Such standards, however, may be required for good appearance and seem to be more stringent for women than for men.

ASSOCIATIONS AMONG THE WEIGHT-FOR-HEIGHT MEASURES

We present a summary of product-moment correlations among all of the continuous measures of weight-for-height in Table 46 for all sites combined. All coefficients were above 0.90 and were highly significant ($p < .001$).

Table 47 summarizes the associations among the measures of the effects of overweight. We observed the strongest association between pain and restricted activity and low to moderate associations among all the other measures.

Table 46

PRODUCT-MOMENT CORRELATIONS AMONG CONTINUOUS MEASURES OF WEIGHT-FOR-HEIGHT
(Enrollment Medical History Questionnaire)

	Measure					
Measure	W/H	W/H$^{1.5}$	W/H^{2}	Standard W/H^{P}	RRWN (NCHS)	RRWL (Life Insurance)
W/H	--					
W/H$^{1.5}$	.99[a]	--				
W/H^{2}	.95	.99	--			
Standard W/H^{P}	.93	.97	.98	--		
RRWN (NCHS recommended)	.92	.96	.99	.98	--	
RRWL (life insurance recommended)	.93	.97	.99	.99	.99	--

[a] All coefficients significant ($p < .001$).

Table 47

Associations among Measures of the Effect of Overweight: Total Sample (Enrollment Medical History Questionnaire)

Measure	Number of Approaches to Losing Weight		Worry/Concern over Weight		Pain Caused by Weight		Restricted Activity Caused by Weight		Overweight Impact Index[a]	
	γ[b]	r[c]	γ	r	γ	r	γ	r	γ	r
Number of approaches to losing weight	--	--								
Worry/concern over weight	.39[d]	.30	--	--						
Pain caused by weight	.29	.17	.61	.35	--	--				
Restricted activity caused by weight	.26	.16	.64	.35	.80	.54	--	--		
Overweight Impact Index	(e)	.29	(e)	.84	(e)	.76	(e)	.71	--	--

[a] Composed of worry/concern, pain, and restricted activity caused by weight.

[b] Gamma coefficient.

[c] Pearson product-moment coefficient.

[d] All coefficients significant (p < .01).

[e] Not calculated because this index is a continuous measure.

VII. HYPOTHESES TO BE TESTED

Our basic hypothesis is that the generosity of insurance will have a beneficial effect on weight. We consider two beneficial effects to be (1) severely overweight people reduce, and normal weight and moderately overweight people do not become severely overweight (i.e., there will be a lower proportion of people in the severely overweight category in the generous plans); and (2) moderately and severely overweight people lose weight (i.e., moderately and severely overweight people will have a lower mean weight in the generous health plans than those enrolled in less generous plans). Because the literature indicates that being severely overweight is associated with poorer health status in the future (e.g., overall mortality, increased prevalence of diabetes and heart disease), we will consider the first beneficial effect as a proxy measure of future health status. The second beneficial effect is less clearly a proxy measure of future health status (i.e., the health risks of being only moderately overweight are minimal if they exist at all). However, there are reasons other than pure health effects that motivate a person to lose weight. Although in this report we did not evaluate the effect of being overweight on social and psychological outcomes, a person's sense of well-being and self-esteem may be improved by losing weight. This may be especially true for younger people (age 45 and under), for whom a high value is placed by society on being thin. To the extent that self-esteem and a sense of well-being are important to the person's overall health, such weight loss may even be beneficial to their health. The inference stated above can and will be tested with HIS data by examining the effect of changes in weight during the course of the HIS on a variety of health status measures.

One of the problems with using weight loss in overweight people as a proxy measure of health status is that weight loss may be a symptom of disease and thus can also be a proxy for poorer health. We will therefore eliminate from the hypothesis testing outlined above those people with diseases that might be associated with sudden weight loss. We can determine and can thus exclude people with cancer, end-stage kidney disease, severe liver disease, malabsorption syndrome (including inflammatory bowel disease), end-stage chronic obstructive pulmonary disease, and severe thyroid problems, as well as those who have had recent major surgery. We will not exclude people with diabetes or with hypertension (unless they also have one of the above ailments).

To be able to use the percentage of people who are severely overweight as a proxy measure of future health status, we must assume that any weight loss achieved by this group of people would be maintained after the end of the Study period. To test this, we have determined the percentage who are severely overweight at enrollment into the Study by insurance plan, and we will determine the percentage at three years (using the three-year exit data) and the percentage at five years (using the five-year exit data). If we observe a reduction in the percentage who are severely overweight at three years, and if the reduction is maintained at five years, we can assume that this reduction would have been maintained beyond the time of the Study if the same insurance plans had remained in force.[1] In this case, the percentage who are severely overweight can be used as a proxy measure of future health status. We recognize that weight loss is difficult to maintain by any individual, but by looking at group effects, we may observe an overall nonrecidivism as a function of insurance plan.

If we find no effect of insurance plan, we will perform additional analyses using various subgroups of the population in which effects might be more likely to occur. For example, we will look at a subgroup of people with hypertension, testing the hypothesis that people with hypertension are more apt to have beneficial weight changes with generous insurance than without generous insurance. Other subgroups of interest are people with coronary heart disease and diabetes.

The reason we expect generous health insurance (i.e., free medical care) to facilitate weight loss is that because the generous insurance plan pays all medical costs, people on this plan may make more doctor visits, visit better trained doctors, visit doctors specializing in weight reduction, or make more well visits—any of which may increase the likelihood of their receiving advice or encouragement to lose weight or not to gain weight. In addition, with free care, people may make more return visits to doctors, which may reinforce any beneficial changes. Through its insurance plan, the HIS also covers all weight-loss programs in which a physician is actively involved. Thus, it will cover frequent visits to the physician for weighing, encouragement, advice, or reassurance. It can be argued that a successful weight-loss program may require more than simply increased quality of physician care. The attainment of maximum weight loss may require behavior modification, diet, and exercise training administered in a group setting without the aid of a physician. However, if such a group setting is offered through a physician's office or is under a physician's control (e.g., hospital outpatient weight-loss clinics), it is also covered by the HIS.

The measures of overweight may also be useful as covariates in analyses that examine the effects of insurance on other health status outcomes. People who are overweight may be more or less compliant with medical advice. Being overweight may be a predictor of use of services, with those who are more overweight using more services, and this may interact with generosity of insurance coverage. Finally, being overweight may serve as a stimulus for improving a variety of other health habits behaviors (e.g., increased exercise, reduced smoking, diet).

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[1] Because the three- and five-year samples are random samples, we can look at trends over time using different groups of people in this way.

Appendix A

CONCEPTUALIZATION AND MEASUREMENT OF EATING HABITS

Eating habits of interest in the HIS are whether people eat breakfast and whether they eat between meals. In this appendix we briefly review how these eating habits have been measured by other investigators, the effect of these habits on health status, how they were measured in the HIS, descriptive statistics based on HIS enrollment data, data on the associations among the measures of eating habits, and on the association between these habits and overweight.

MEASUREMENT OF EATING HABITS

Eating Breakfast

To assess eating breakfast, there are three variables of interest: the regularity of eating breakfast and the type and amount of breakfast eaten. These may be assessed in several ways: by asking the frequency with which certain foods are usually eaten; by having respondents keep a detailed diary of the frequency, type, and amount of food eaten at breakfast; or by simply asking people how often they eat breakfast. In the latter method, the definition of breakfast is left up to the respondents (e.g., is a cup of coffee with cream and sugar considered breakfast?).

We found no information in the literature on the reliability of measures of eating breakfast. Some validity studies have been done, although none compared self-reported data with more objective measures of food consumption. These studies compared different methods of obtaining self-reported data (e.g., a short questionnaire asking about frequency of consumption versus a detailed interview). In one study, correlations of over 0.80 were found between frequency of food consumption reported on a short questionnaire and on amounts reported in a more detailed interview (Abramson, Slome, and Kosovsky, 1963). In another study, when data obtained using a short questionnaire to assess specific nutrients were compared with data obtained by extensive dietary histories, the validity of the short questionnaire varied depending on sex, age, ethnic group, education, and variety of diet (Epstein, Reshef, Abramson, et al., 1970).

Eating between Meals

As with eating breakfast, the most precise method of assessing eating between meals may be a detailed diary assessing the frequency, type, and amount of food eaten during the day. No information was available in the literature on the reliability or validity of measures of eating between meals.

EFFECTS OF EATING HABITS ON HEALTH STATUS

We reviewed only three studies of the effects of eating breakfast on health status. One assessed eating breakfast in relation to incidence of employee visits to industrial health facilities (Miller, 1971). A second study assessed eating habits in relation to physiologic responses such as maximum work output, reaction time, and tremor (Tuttle, Wilson, and Daum, 1949). The third study looked at eating breakfast in relation to premature mortality (Belloc, 1973) and physical health (Belloc and Breslow, 1972). The effects of eating between meals has been studied in relation to premature mortality (Belloc, 1973) and to physical health status (Belloc and Breslow, 1972). Table A.1 gives a summary of the findings of these studies.

All studies found a trend in the direction of poorer health status for people who do not eat breakfast and who eat between meals almost every day, and it was significant where tested. The trend was more apparent for not eating breakfast than for eating between meals; when men and women were evaluated separately,

Table A.1

EFFECTS OF EATING HABITS ON HEALTH STATUS

Eating Habit	Measure of Health Status and Effect	Method and/or Data	Population	Reference
Eating breakfast	Mortality due to all causes was greater for those eating breakfast sometimes or rarely than for those eating breakfast almost every day, especially for men	Proportion dying in 5.5 years (age adjusted): Eat Breakfast — Men — Women Almost every day — .06 — .04 Sometimes or rarely — .11 — .06 (significance not tested)	6928 people aged 18 and older	Belloc, 1973
	Physical health was poorer for those eating breakfast sometimes, rarely, or never than for those eating breakfast almost every day	Age-sex related ridit[a] (95% confidence interval in parentheses): Eat Breakfast — Men — Women Almost every day — .49 (.01) — .49 (.01) Sometimes — .52 (.02) — .52 (.02) Rarely or never — .51 (.03) — .53 (.02)	6928 people aged 18 and older	Belloc and Breslow, 1972
	More visits to an industrial health facility were made by those not eating an adequate breakfast compared to those eating an adequate breakfast	$\chi^2 = 11.36$ ($p < .01$), comparing adequate breakfast (yes, no) with visits to the health unit (yes, no)	80 people, median age 44	Miller, 1971
	Work output, reaction time, and tremor were adversely affected in people who did not eat an adequate breakfast	Experimental study: Outcome — t Work output — 8.78 ($p < .001$) Reaction times — 4.00 ($p < .01$) 3.60 ($p < .01$) Tremor — 3.17 ($p < .01$)	6 women aged 22-27	Tuttle, Wilson, and Daum, 1949
Eating between meals	Mortality due to all causes was greater for those eating between meals almost every day than for those doing so rarely or occasionally, especially for men	Proportion dying in 5.5 years (age adjusted): Eat between Meals — Men — Women Almost every day — .09 — .05 Rarely or occasionally — .06 — .04 (significance not tested)	6928 people aged 18 and older	Belloc, 1973
	Physical health is poorer for those eating between meals almost every day than for those doing so rarely or occasionally	Age-sex related ridit (95% confidence interval in parentheses): Eat between Meals — Men — Women Almost every day — .54 (.02) — .52 (.02) Once in a while — .48 (.02) — .49 (.01) Rarely or never — .49 (.02) — .49 (.02)	6928 people aged 18 and older	Belloc and Breslow, 1972

[a] A higher ridit indicates poorer health status. See Belloc and Breslow, 1972.

the trend was more apparent for men than for women. No studies were available, however, that would allow one to conclude that changing these eating habits would result in better health status or less premature mortality, and these results could represent a spurious association produced by some third unmeasured variable such as personality.

MEASUREMENT OF EATING HABITS IN THE HEALTH INSURANCE STUDY

Items Used To Measure Eating Habits

We used two questionnaire items in the HIS to measure eating habits, based on questions asked in the Human Population Laboratory Study (Belloc and Breslow, 1972). The items are shown in Table A.2. After the two original items were administered in Dayton, a slight revision was made in one item. The revised items were used for all subsequent administrations in Dayton and at all administrations in the other sites.

Frequency of Administration

The eating habits items are administered at several times throughout the course of the study; they are administered at three points for people enrolled for three years and four or five points (depending on the site) for people enrolled for five years. Table A.3 shows the schedule of administration.

Measures of Eating Habits

We constructed three measures from the two eating habits items: frequency of eating breakfast, frequency of eating between meals, and the number of positive eating habits.

Frequency of Eating Breakfast. We based an ordinal measure of frequency of eating breakfast on item 21 (item 2 in Dayton) and recoded the item so that a high score indicated positive eating habits (i.e., more likely to eat breakfast).

Frequency of Eating between Meals. We constructed an ordinal measure of frequency of eating between meals based on item 22 (item 3 in Dayton). Response categories were slightly different in Dayton. A higher score indicated *less* frequent eating between meals (i.e., a more positive habit).

Number of Positive Eating Habits. We counted the number of positive eating habits. The criteria for "positive" were eating breakfast every day and eating between meals occasionally, rarely, or never. Scores could range from 0 to 2. We assigned a missing value if either of the eating habits items was missing.

Descriptive Statistics of Eating Habits Measures

Table A.4 presents frequency distributions and descriptive statistics for the three eating habits measures for all six sites and for all sites combined. We noted that the percentage of missing data was very small, less than 1 percent in all sites. About half the respondents eat breakfast every day (range was from 40 to 57

Table A.2

Items Used in the Health Insurance Study To Measure Eating Habits

Item	Item Content	
	Version One[a]	
2[b]	How often do you eat breakfast?	Almost every day .... 1 Sometimes .... 2 Rarely or never 3
3[b]	How often do you eat *in between* your regular meals?	Almost every day .... 1 Sometimes .... 2 Rarely or never 3
	Version Two[c]	
21[d]	How often do you eat breakfast?	Almost every day .... 1 Sometimes .... 2 Rarely or never 3
22[d]	How often do you eat something *in between* your regular meals?	About 3 times a day or more .... 1 About twice a day ... 2 Maybe once a day .... 3 Occasionally, not every day .... 4 Rarely or never 5

[a] Enrollment Medical History Questionnaire for Dayton only.

[b] Item number from Form A, Part 1, Dayton Enrollment Medical History Questionnaire.

[c] Enrollment Medical History Questionnaire for Seattle, Fitchburg/Franklin Co., and Charleston/Georgetown Co.; Exit Medical History Questionnaire for all sites.

[d] Item number from Form A, Enrollment Medical History Questionnaire.

percent across sites). The "between meals" measure in Dayton was sufficiently different to preclude comparison with measures obtained in other sites. For the other five samples, about 33 percent eat between meals occasionally, rarely, or never (range was from 30 to 37 percent). In the five comparable samples, about 15 percent of the respondents practice both positive habits, that is, eat breakfast and eat between meals less often than about once per day (range was from 11 to 17).

RELIABILITY AND VALIDITY

The reliability of the HIS eating habits measures could not be tested.

Validity studies were intended to add to our understanding of the meaning of the two measures. These studies were not meant to test the criterion validity of the measures (e.g., comparing these self-reported measures with more objective indicators).

We performed two types of studies: (1) tests of the association between eating breakfast and not eating between meals, and (2) tests of the association between these two measures of eating habits and measures of overweight.

Table A.3

SCHEDULE OF ADMINISTRATION OF EATING HABITS ITEMS IN THE HEALTH INSURANCE STUDY

Questionnaire	Time of Administration[a]	Dayton	All Other Sites
Enrollment Medical History Questionnaire	Enrollment	x[b]	x
Health Questionnaire 1	End of first year in study	o	o
Health Questionnaire 2	End of second year in study	x	x
Health Questionnaire 3	End of third year in study (five-year enrollees only)	x	o
Health Questionnaire 4	End of fourth year in study (five-year enrollees only)	x	x
Exit Medical History Questionnaire	Exit (at end of three or five years)	x	x

[a] The actual dates vary because enrollment dates were staggered across sites and across individuals within sites.

[b] An "x" indicates that the eating habits battery was included in the questionnaire; and "o" indicates that it was not included.

Associations between Eating Breakfast and Not Eating between Meals

Table A.5 summarizes the associations between eating breakfast and not eating between meals. Except in Dayton, all but one of the associations were low but significant (all coefficients were less than 0.16), linear (as evidenced by gamma and product-moment coefficients of similar magnitude), and negative; people who are more likely to eat breakfast are more likely to eat between meals. Thus, there is a slight tendency for people to eat (both breakfast and between meals) or not to eat (breakfast or between meals).

This explains why most of the respondents (about 51 percent) received a score of one on the number of positive eating habits measure (see Table A.4); that is, because people tend to either eat or not eat, they are generally adhering to one positive and one negative eating habit.

Table A.4

FREQUENCY DISTRIBUTION OF EATING HABITS MEASURES FOR SIX HEALTH INSURANCE STUDY SAMPLES: PEOPLE AGED 17 TO 61
(Enrollment Medical History Questionnaire)

Measure	Dayton (N=1212)		Seattle (N=2235)		Fitchburg (N=483)		Franklin Co. (N=585)		Charleston (N=634)		Georgetown Co. (N=666)		All Sites Combined (N=5815)	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Frequency Eat Breakfast														
1 - Rarely or never	221	18	446	30	93	19	97	17	150	24	156	23	1163	20
2 - Sometimes	364	30	625	28	148	31	152	26	213	34	244	37	1746	30
3 - Almost every day	627	52	1160	52	241	50	336	57	267	42	263	40	2894	50
Missing	0	0	4	0	1	0	0	0	4	1	3	0	12	0
Total	1212	100	2235	100	483	100	585	100	634	101[a]	666	100	5815	100
Frequency Eat between Meals														
1 - About 3 times a day or more	440	36	225	10	74	15	79	14	89	14	105	16	572	12
2 - About twice a day			577	26	150	31	165	28	190	30	189	28	1271	28
3 - Maybe once a day			601	27	105	22	159	27	139	22	168	25	1172	25
4 - Occasionally, not every day	612	50	630	28	120	25	142	24	154	24	155	23	1201	26
5 - Rarely or never	160	13	196	9	33	7	38	7	57	9	47	7	371	8
Missing	0	0	6	0	1	0	2	0	5	1	2	0	16	0
Total	1212	99[a]	2235	100	483	100	585	100	634	100	666	99[a]	4603[b]	99[a]
Number of Positive Eating Habits														
0 - Don't eat breakfast every day and do eat between meals	211	17	627	28	159	33	162	28	228	36	269	40	1656	28
1 - Either eat breakfast every day or don't eat between meals	603	50	1218	54	252	52	327	56	323	51	323	48	3046	52
2 - Eat breakfast every day and don't eat between meals	398	33	381	17	71	15	94	16	77	12	71	11	1092	19
Missing	0	0	9	0	1	0	2	0	6	1	3	0	21	0
Total	1212	100	2235	99[a]	483	100	585	100	634	100	666	99[a]	5815	99[a]

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[a] Does not equal 100.0 due to rounding error.

[b] Dayton not included in these totals.

Table A.5

ASSOCIATIONS BETWEEN MEASURES OF EATING BREAKFAST AND NOT EATING BETWEEN MEALS FOR SIX HEALTH INSURANCE STUDY SAMPLES: PEOPLE AGED 14 TO 61
(Enrollment Medical History Questionnaire)

		Measure of Association	
Sample	N	Gamma	r[a]
Dayton	1212	.03	.02
Seattle	2235	-.14[†]	-.11[†]
Fitchburg	483	-.12[*]	-.10[*]
Franklin County	585	-.08	-.07[*]
Charleston	634	-.12[*]	-.10[†]
Georgetown County	666	-.11[*]	-.08[*]
All sites combined	4582[b]	-.12[†]	-.10[†]

[*] $p < .05$.

[†] $p < .01$.

[a] r = product-moment correlation.

[b] Dayton not included in this analysis.

Eating Habits and Overweight

We summarize the associations between the three measures of eating habits and the two measures of overweight (subjective evaluation and the criterion measure) in Table A.6 for all sites combined. None of the coefficients were significant. Thus, for these measures there appears to be no association between these eating habits and being overweight.

Table A.6

ASSOCIATIONS BETWEEN EATING HABITS AND OVERWEIGHT FOR ALL SITES COMBINED

	Overweight			
	Subjective Evaluation		Criterion Measure	
Eating Habits	r^a	γ^b	r^a	γ^b
Eat breakfast[c]	.02	.03	-.00	-.01
Eat between meals[d]	-.02	-.03	-.01	.00
Number of positive eating habits	.01	.02	-.02	-.03

[a] Pearson product-moment coefficient.

[b] Gamma coefficient.

[c] A high score indicates eating breakfast more frequently.

[d] A high score indicates eating between meals less frequently.

Appendix B

DATA REGARDING THE ASSOCIATIONS AMONG MEASURES OF WEIGHT

Table B.1

Associations[a] between Weight-for-Height Measures and Measures of Body Fatness

Weight for Height Measure	Measure of Body Fatness												
	Body Density (BD)/Relative Adiposity (RA)[b]				Sum of Triceps and Subscapular Skinfolds			Subscapular Skinfold			Triceps Skinfold		
	RA or BD	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference
W/H	RA	0.70	26 women	Billewicz, Kemsley, and Thomson, 1962[c]	0.83	134 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972	0.65	2202 women	Florey, 1970	0.45	1723 men aged 40+	Florey, 1970
	RA	0.74	55 men		0.77	248 men aged 49-59		0.64	1723 men aged 40+			1430 men aged 40+	Goldbourt and Medalie, 1974
	RA	0.57	97 men	Brockett, Brophy, Konishi, et al., 1956	0.76	116 men aged 31-60		0.60	1430 men aged 40+	Goldbourt and Medalie, 1974	0.47	2202 women	Florey, 1970
					0.61	499 men aged 40-59							
	BD	-0.83	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972	0.75	926 men aged 40-59							
	BD	-0.66	249 men aged 49-59		0.76	871 men aged 40-59							
	BD	-0.72	209 men aged 17-72	Womersley and Durnin, 1974	0.77	997 men aged 40-59							
	BD	-0.78	272 women aged 16-68		0.80	836 men aged 40-59							
					0.71	978 men aged 40-59							
					0.79	636 men aged 40-59							
					0.77	802 men aged 40-59							
W/H^2	RA	0.72	26 women	Billewicz, Kemsley, and Thomson, 1962[c]	0.85	134 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972	0.66	2202 women	Florey, 1970	0.42	1723 men aged 40+	Florey, 1970
	RA	0.80	55 men		0.78	248 men aged 49-59		0.64	1723 men aged 40+		0.40	1430 men aged 40+	Goldbourt and Medalie, 1974
	RA	0.60	97 men	Brockett, Brophy, Konishi, et al., 1956	0.73	116 men aged 31-60		0.60	1430 men aged 40+	Goldbourt and Medalie, 1974	0.46	2202 women	Florey, 1970
					0.61	499 men aged 40-59							
	BD	-0.85	180 men aged 18-24	Keys, Fidanza, Karvonun, et al., 1972	0.76	926 men aged 40-59							
	BD	-0.67[d]	249 men aged 40-59		0.77	871 men aged 40-59							
	BD	-0.76	209 men aged 17-72	Womersley and Durnin, 1974	0.79	997 men aged 40-59							
		-0.79	272 women aged 16-68		0.80	836 men aged 40-59							
					0.71	978 men aged 40-59							
					0.80	636 men aged 40-59							
					0.76	802 men aged 40-59							

Weight for Height Measure	Measure of Body Fatness												
	Body Density (BD)/Relative Adiposity (RA)[b]				Sum of Triceps and Subscapular Skinfolds			Subscapular Skinfold			Triceps Skinfold		
	RA or BD	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference
W/H^3	BD	-0.79	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972									
	BD	-0.66[d]	249 men aged 49-59										
	BD	-0.76	209 men aged 17-72	Womersley and Durnin, 1974									
	BD	-0.78	272 women aged 16-68										
$H/\sqrt[3]{W}$[e]	RA	-0.68	26 women	Billewicz, Kemsley, and Thomson, 1962[c]	-0.79	134 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972[f]	-0.64	2202 women	Florey, 1970	-0.36	1723 men aged 40+	Florey, 1970
	RA	-0.77	55 men		-0.74	248 men aged 49-59		-0.59	1723 men aged 40+		-0.36	1430 men aged 40+	Goldbourt and Medalie, 1974
	RA	-0.57	97 men	Brockett, Brophy, Konishi, et al., 1956	-0.63	116 men aged 31-60		-0.56	1430 men aged 40+	Goldbourt and Medalie, 1974	-0.44	2202 women	Florey, 1970
					-0.52	499 men aged 40-59							
					-0.69	926 men aged 40-59							
					-0.73	871 men aged 40-59							
					-0.71	997 men aged 40-59							
					-0.72	836 men aged 40-59							
					-0.66	978 men aged 40-59							
					-0.73	636 men aged 40-59							
					-0.71	802 men aged 40-59							
Relative Ideal Weight								0.74	813 women aged 40-49	Kannel and Gordon, 1974			
								0.67	676 women aged 50-59				
								0.69	417 women aged 60-69				
								0.68	627 men aged 40-49				
								0.68	489 men aged 50-59				
								0.60	282 men aged 60-69				

Table B.1—continued

Weight for Height Measure	Measure of Body Fatness												
	Body Density (BD)/Relative Adiposity (RA)[b]				Sum of Triceps and Subscapular Skinfolds			Subscapular Skinfold			Triceps Skinfold		
	RA or BD	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference	r	Sample	Reference
Relative Average Weight	BD	-0.78	116 men "younger"	Brožek and Keys, 1951	0.85	134 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972	0.86	116 men "younger"	Brožek and Keys, 1951	0.78	116 men "younger"	Brožek and Keys, 1951
	BD	-0.63	214 men "older"		0.77	248 men aged 49-59		0.75	214 men "older"		0.64	214 men "older"	
					0.69	116 men aged 31-60							
					0.56	499 men aged 40-59							
					0.75	926 men aged 40-59							
					0.77	871 men aged 40-59							
					0.78	997 men aged 40-59							
					0.80	836 men aged 40-59							
					0.71	978 men aged 40-59							
					0.80	636 men aged 40-59							
					0.77	802 men aged 40-59							

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[a] Product-moment correlations.

[b] Body density (BD) is negatively correlated with body fatness (i.e., more dense is less fat). Relative adiposity (RA) is derived from body density and is positively correlated with body fatness.

[c] Calculated based on data reported by Allen, Peng, Chen, et al., 1956.

[d] The original article omitted the negative sign. We assume this was a typographical error.

[e] The index $H/\sqrt[3]{W}$ increases as weight decreases.

[f] All correlations were reported as positive by Keys, Fidanza, Karvonen, et al.; we assume this represents an adjustment by the authors and we have reversed the signs.

Table B.2

ASSOCIATIONS[a] OF MEASURES OF WEIGHT-FOR-HEIGHT WITH HEIGHT AND WEIGHT

	Height			Weight		
Measure	r	Sample	Reference	r	Sample	Reference
W/H	0.03	2519 women	Florey, 1970	0.97[b]	2519 women	Florey, 1970
	0.27	26 women	Billewicz, Kemsley, and Thomson, 1962[c]	0.96	2003 men aged 40+	
	0.22	2003 men aged 40+	Florey, 1970	0.96	1430 men aged 40+	Goldbourt and Medalie, 1974
	0.28	1430 men aged 40+	Goldbourt and Medalie, 1974	0.97	459 men aged 15-19	Khosla and Lowe, 1967
	0.37	459 men aged 15-19	Khosla and Lowe, 1967	0.97	617 men aged 20-24	
	0.28	617 men aged 20-24		0.97	633 men aged 25-29	
	0.19	633 men aged 25-29		0.97	597 men aged 30-34	
	0.30	597 men aged 30-34		0.97	633 men aged 35-39	
	0.30	633 men aged 35-39		0.97	494 men aged 40-44	
	0.28	494 men aged 40-44		0.97	551 men aged 45-49	
	0.29	551 men aged 45-49		0.97	478 men aged 50-54	
	0.27	478 men aged 50-54		0.96	399 men aged 55-59	
	0.36	399 men aged 55-59		0.97	261 men aged 60-64	
	0.22	261 men aged 60-64				
	0.41	55 men	Billewicz, Kemsley, and Thomson, 1962[c]			
	0.26	97 men	Brockett, Brophy, Konishi, et al., 1956			
	0.25	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972			
	0.18	249 men aged 49-59				
	0.51	116 men aged 31-60				
	0.27	499 men aged 40-59				
	0.18	535 men aged 40-59				
	0.25	926 men aged 40-59				
	0.17	871 men aged 40-59				
	0.27	797 men aged 40-59				
	0.28	836 men aged 40-59				
	0.34	978 men aged 40-59				
	0.22	636 men aged 40-59				
	0.27	802 men aged 40-59				

Table B.2—continued

Measure	Height			Weight		
	r	Sample	Reference	r	Sample	Reference
W/H^2	-0.20	2519 women	Florey, 1970	0.90	2519 women	Florey, 1970
	0.03	26 women	Billewicz, Kemsley, and Thomson, 1962[c]	0.83	2003 men aged 40+	
	-0.08	2003 men aged 40+	Florey, 1970	0.83	1430 men aged 40+	Goldbourt and Medalie, 1974
	-0.03	1430 men aged 40+	Goldbourt and Medalie, 1974	0.85	459 men aged 15-19	Khosla and Lowe, 1967
	-0.08	459 men aged 15-19	Khosla and Lowe, 1967	0.84	617 men aged 20-24	
	-0.02	617 men aged 20-24		0.85	633 men aged 25-29	
	-0.10	633 men aged 25-29		0.86	597 men aged 30-34	
	0.02	597 men aged 30-34		0.85	633 men aged 35-39	
	0.00	633 men aged 35-39		0.86	494 men aged 40-44	
	-0.01	494 men aged 40-44		0.86	551 men aged 45-49	
	0.00	551 men aged 45-49		0.86	478 men aged 50-54	
	-0.02	478 men aged 50-54		0.83	399 men aged 55-59	
	0.05	399 men aged 55-59		0.85	261 men aged 60-64	
	-0.06	261 men aged 60-64				
	0.16	55 men	Billewicz, Kemsley, and Thomson, 1962[c]			
	-0.08	97 men	Brockett, Brophy, Konishi, et al., 1956			
	0.02	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972			
	0.06	249 men aged 49-59				
	0.24	116 men aged 31-60				
	0.04	499 men aged 40-59				
	0.16	535 men aged 40-59				
	0.06	926 men aged 40-59				
	0.10	871 men aged 40-59				
	0.00	797 men aged 40-59				
	0.04	836 men aged 40-59				
	0.09	978 men aged 40-59				
	0.01	636 men aged 40-59				
	0.03	802 men aged 40-59				

Table B.2—continued

	Height			Weight		
Measure	r	Sample	Reference	r	Sample	Reference
W/H^3 or $\sqrt[3]{W}/H$	-0.24	459 men aged 15-19	Khosla and Lowe, 1967	0.63	459 men aged 15-19	Khosla and Lowe, 1967
	-0.32	617 men aged 20-24		0.63	617 men aged 20-24	
	-0.36	633 men aged 25-29		0.68	633 men aged 25-29	
	-0.27	597 men aged 30-34		0.67	597 men aged 30-34	
	-0.29	633 men aged 35-39		0.65	633 men aged 35-39	
	-0.29	494 men aged 40-44		0.67	494 men aged 40-44	
	-0.28	551 men aged 45-49		0.67	551 men aged 45-49	
	-0.29	478 men aged 50-54		0.68	478 men aged 50-54	
	-0.28	399 men aged 55-59		0.60	399 men aged 55-59	
	-0.33	261 men aged 60-64		0.68	261 men aged 60-64	
$H/\sqrt[3]{W}$ [d]	0.41	2519 women	Florey, 1970	-0.77	2519 women	Florey, 1970
	0.24	26 women	Billewicz, Kemsley, and Thomson, 1962[c]; Florey, 1970	-0.64	2003 men aged 40+	
	0.36	2003 men aged 40+	Florey, 1970	-0.64	1430 men aged 40+	Goldbourt and Medalie, 1974
	0.31	1430 men aged 40+	Goldbourt and Medalie, 1974			
	0.16	55 men	Billewicz, Kemsley, and Thomson, 1962[c]			
	0.40	97 men	Brockett, Brophy, Konishi, et al., 1956			
	0.24	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972			
	0.30	249 men aged 49-59				
	0.10	116 men aged 31-60				
	0.36	499 men aged 40-59				
	0.47	535 men aged 40-59				
	0.34	976 men aged 40-59				
	0.35	871 men aged 40-59				
	0.28	797 men aged 40-59				
	0.22	836 men aged 40-59				
	0.18	978 men aged 40-59				
	0.25	636 men aged 40-59				
	0.21	802 men aged 40-59				

Table B.2—continued

	Height			Weight		
Measure	**r**	**Sample**	**Reference**	**r**	**Sample**	**Reference**
Relative Average Weight	0.04	180 men aged 18-24	Keys, Fidanza, Karvonen, et al., 1972			
	0.10	249 men aged 49-59				
	0.32	116 men aged 31-60				
	0.15	499 men aged 40-59				
	0.08	535 men aged 40-59				
	0.07	926 men aged 40-59				
	0.12	871 men aged 40-59				
	0.06	797 men aged 40-59				
	0.05	836 men aged 40-59				
	0.16	978 men aged 40-59				
	0.08	636 men aged 40-59				
	0.10	802 men aged 40-59				

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[a] Product-moment correlations.

[b] The original article printed 8.97 for the correlation. We assumed that the 8 was a typographical error.

[c] Calculated based on data reported by Allen, Peng, Chen, et al., 1956.

[d] The index $H/\sqrt[3]{W}$ increases as weight decreases.

Appendix C

TABLES OF RECOMMENDED WEIGHTS

Table C.1

RECOMMENDED WEIGHTS[a] AS DERIVED BY THE METROPOLITAN LIFE INSURANCE COMPANY[b] FOR PEOPLE OF MEDIUM FRAME AGED 25 AND OLDER

Height in Inches[c]	Weight in Pounds[d]			
	Men		Women	
	Range	Midpoint	Range	Midpoint
56	--	--	96-107	101.5
57	--	--	98-110	104.0
58	--	--	101-113	107.0
59	--	--	104-116	110.0
60	--	--	107-119	113.0
61	118-129	123.5	110-122	116.0
62	121-133	127.0	113-126	119.5
63	124-136	130.0	116-130	123.0
64	127-139	133.0	120-135	127.5
65	130-143	136.5	124-139	131.5
66	134-147	140.5	128-143	135.5
67	138-152	145.0	132-147	139.5
68	142-156	149.0	136-151	143.5
69	146-160	153.0	140-155	147.5
70	150-165	157.5	144-159	151.5
71	154-170	162.0	--	--
72	158-175	166.5	--	--
73	162-180	171.0	--	--
74	167-185	176.0	--	--
75	172-190	181.0	--	--

[a] Weight at which a person has the best chance of survival.

[b] Metropolitan Life Insurance Company, 1960.

[c] Heights have been corrected for heels; 1 inch has been subtracted from height for men and 2 inches for women (i.e., life insurance company tables report height with shoes on).

[d] To calculate recommended weights for the HIS measures, 2 pounds were subtracted from these midpoints to account for clothes (i.e., life insurance company tables report weight in clothes).

Table C.2

Recommended Weights[a] as Derived by the National Center for Health Statistics[b] for Men and Women Aged 20 to 74

	Weight in Pounds	
Height in Inches	Men	Women
57	--	113
58	--	117
59	--	120
60	--	123
61	--	127
62	136	130
63	140	134
64	145	137
65	150	140
66	155	144
67	159	147
68	163	151
69	168	154
70	173	158
71	178	--
72	182	--
73	187	--
74	192	--

[a] Based on average weights of men and women aged 20 to 29.

[b] See Table 1, USDHEW, 1979b.

Appendix D

FREQUENCY DISTRIBUTIONS AND DESCRIPTIVE STATISTICS FOR ITEMS MEASURING WEIGHT AND OVERWEIGHT FOR PEOPLE AGED 14 AND OLDER: MEDICAL HISTORY QUESTIONNAIRE AND MEDICAL SCREENING EXAMINATION

Table D.1

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: DAYTON ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

Item[a]	Item Content	Response	Men (N=569) Number	Men (N=569) Percent of Men	Men (N=569) Adjusted Percent[c]	Women (N=632) Number	Women (N=632) Percent of Women	Women (N=632) Adjusted Percent[c]	Total (N=1212)[b] Number	Total (N=1212)[b] Percent of Total	Total (N=1212)[b] Adjusted Percent[c]
1	How tall are you without shoes on? ____ feet	responded	567	99.6	--	632	100.0	--	1210	99.8	--
		missing	2	0.4		0	0.0		2	0.2	
			569	100.0		632	100.0		1212	100.0	
	____ inches	responded	564	99.1	--	632	100.0	--	1207	99.6	--
		missing	5	0.9		0	0.0		5	0.4	
			569	100.0		632	100.0		1212	100.0	
42	How much do you weigh without heavy clothes? _____ pounds	responded	567	99.6	--	631	99.8	--	1209	99.8	--
		missing	2	0.4		1	0.2		3	0.2	
			569	100.0		632	100.0		1212	100.0	
43	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.] _____ pounds	responded	554	97.4	--	630	99.7	--	1194	98.5	--
		missing	15	2.6		2	0.3		18	1.5	
			569	100.0		632	100.0		1212	100.0	
44	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	169	29.7	--	279	44.1	--	454	37.5	--
		2 - no[d]	400	70.3		353	55.9		758	62.5	
		missing	0	0.0		0	0.0		0	0.0	
			569	100.0		632	100.0		1212	100.0	
47	Are you currently on a diet to lose weight?	1 - yes	29	5.1	17.2	105	16.6	37.6	135	11.1	29.7
		2 - no	140	24.6	82.8	173	27.4	62.0	318	26.2	70.0
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	1	0.2	0.4	1	0.1	0.2
			569	100.0	100.0	632	100.1[e]	100.0	1212	99.9[e]	99.9[e]
49	Are you doing any special exercises to lose weight?	1 - yes	23	4.0	13.6	76	12.0	27.2	99	8.2	21.8
		2 - no	145	25.5	85.8	203	32.1	72.8	354	29.2	78.0
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	1	0.2	0.6	0	0.0	0.0	1	0.1	0.2
			569	100.0	100.0	632	100.0	100.0	1212	100.0	100.0

			Men (N=569)			Women (N=632)			Total (N=1212)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
46	Are you taking any reducing pills which have been prescribed by a doctor	1 - yes	6	1.1	3.6	22	3.5	7.9	28	2.3	6.2
		2 - no	163	28.6	96.4	257	40.7	92.1	426	35.1	93.8
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
			569	100.0	100.0	632	100.1[e]	100.0	1212	99.9[e]	100.0
45	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	10	1.8	5.9	29	4.6	10.4	39	3.2	8.6
		2 - no	159	27.9	94.1	250	39.6	89.6	415	34.2	91.4
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
			569	100.0	100.0	632	100.1[e]	100.0	1212	99.9[e]	100.0
48	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	13	2.3	7.[illegible]	38	6.0	13.6	51	4.2	11.2
		2 - no	156	27.4	92.[illegible]	241	38.1	86.4	403	33.3	88.8
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
			569	100.0	100.0	632	100.0	100.0	1212	100.0	100.0
50	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	14	2.5	8.3	63	10.0	22.6	78	6.4	17.2
		2 - somewhat	33	5.8	19.5	73	11.6	26.2	107	8.8	23.6
		3 - a little	92	16.2	54.4	120	19.0	43.2	216	17.8	47.6
		4 - not at all	30	5.3	17.8	23	3.6	8.2	53	4.4	11.7
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
			569	100.1[e]	100.0	632	100.1[e]	100.0	1212	99.9[e]	100.1[e]
Not included	During the past 3 months, how much pain has your weight caused you?	1 - a great deal 2 - some pain 3 - a little pain 4 - no pain at all	--	--	--	--	--	--	--	--	--
51	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	3	0.5	1.1	3	0.2	0.7
		2 - most of the time	2	0.4	1.2	8	1.3	2.9	10	0.8	2.2
		3 - some of the time	7	1.2	4.1	13	2.1	4.7	21	1.7	4.6
		4 - a little of the time	15	2.6	8.9	19	3.0	6.8	34	2.8	7.5
		5 - none of the time	145	25.5	85.8	236	37.3	84.6	386	31.8	85.0
		skipped item	400	70.3	--	353	55.9	--	758	62.5	--
		missing	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
			569	100.0	100.0	632	100.1[e]	100.1[e]	1212	99.9[e]	100.0

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[a] Item number from Enrollment Medical History Questionnaire, Form A, part 1.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who did not skip item.

[d] If no, all remaining items skipped.

[e] Does not equal 100.0 due to rounding error.

Table D.2

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: SEATTLE ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

			Men (N=979)			Women (N=1088)			Total (N=2235)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
1	How tall are you without shoes on?	responded	967	98.8	--	1070	98.3	--	2205	98.7	--
		missing	12	1.2		18	1.2		30	1.3	
	____ feet		979	99.0		1088	100.0		2235	100.0	
	____ inches	responded	949	96.9	--	1058	97.2	--	2173	97.2	--
		missing	30	3.1		30	2.8		62	2.8	
			979	100.0		1088	100.0		2235	100.0	
2	How much do you weigh without heavy clothes?	responded	966	98.7	--	1049	96.4	--	2183	97.7	--
		missing	13	1.3		39	3.6		52	2.3	
			979	100.0		1088	100.0		2235	100.0	
	____ pounds										
26	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.]	responded	976	99.7	--	1080	99.3	--	2224	99.5	--
		missing	3	0.3		8	0.7		11	0.5	
			979	100.0		1088	100.0		2235	100.0	
27	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	321	32.8		624	57.4		1024	45.8	
		2 - no[d]	658	67.2	--	463	42.6	--	1210	54.1	--
		missing	0	0.0		1	0.1		1	0.0	
			979	100.0		1088	100.1[e]		2235	99.9[e]	
27-A	Are you currently on a diet to lose weight?	1 - yes	60	6.1	18.7	267	24.5	42.7	351	15.7	34.2
		2 - no	260	26.6	81.0	353	32.4	56.5	667	29.8	65.1
		skipped item	584	59.6	--	398	36.6	--	1065	47.6	--
		should have skipped but didn't	74	7.6	--	65	6.0	--	145	6.5	--
		missing	1	0.1	0.3	5	0.4	0.8	7	0.3	0.7
			979	100.0	100.0	1088	99.9[e]	100.0	2235	99.9[e]	100.0
27-B	Are you doing any special exercises to lose weight?	1 - yes	67	6.8	20.9	207	19.0	33.1	297	13.3	29.0
		2 - no	253	25.8	78.8	412	37.9	65.9	721	32.2	70.3
		skipped item	590	60.3	--	403	37.0	--	1076	48.1	--
		should have skipped but didn't	68	6.9	--	60	5.0	--	134	6.0	--
		missing	1	0.1	0.3	6	0.6	1.0	7	0.3	0.7
			979	99.9[e]	100.0	1088	100.0	100.0	2235	99.9[e]	100.0

			Men (N=979)			Women (N=1088)			Total (N=2235)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-C	Are you taking any reducing pills which have been prescribed by a doctor?	1 - yes	1	0.1	0.3	23	2.1	3.7	29	1.3	2.8
		2 - no	320	32.7	99.7	599	55.0	95.8	993	44.4	96.9
		skipped item	583	59.6	--	399	36.7	--	1066	47.7	--
		should have skipped but didn't	75	7.7	--	64	5.9	--	144	6.4	--
		missing	0	0.0	0.0	3	0.3	0.5	3	0.1	0.3
			979	100.1[e]	100.0	1088	100.0	100.0	2235	99.9[e]	100.0
27-D	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	10	1.0	3.1	50	4.6	8.0	64	2.9	6.2
		2 - no	311	31.8	96.9	574	52.8	91.8	960	43.0	93.6
		skipped item	584	59.6	--	401	36.8	--	1070	47.9	--
		should have skipped but didn't	74	7.6	--	62	5.7	--	140	6.3	--
		missing	0	0.0	0.0	1	0.1	0.2	1	0.0	0.1
			979	100.0	100.0	1088	100.0	100.0	2235	100.1[c]	99.9[e]
27-E	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	6	0.6	1.9	39	3.6	6.2	50	2.2	4.9
		2 - no	315	32.2	98.1	585	53.8	93.6	974	43.6	95.0
		skipped item	586	59.8	--	402	36.9	--	1073	48.0	--
		should have skipped but didn't	72	7.4	--	61	5.6	--	137	6.1	--
		missing	0	0.0	0.0	1	0.1	0.2	1	0.0	0.1
			979	100.0	100.0	1088	100.0	100.0	2235	99.9[e]	100.0
27-F	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	18	1.8	5.6	199	18.3	31.8	230	10.3	22.4
		2 - somewhat	72	7.4	22.4	191	17.6	30.6	285	12.8	27.8
		3 - a little	181	18.5	56.4	206	18.9	33.0	418	18.7	40.8
		4 - not at all	49	5.0	15.3	28	2.6	4.5	89	4.0	8.7
		skipped item	586	59.8	--	402	36.9	--	1072	48.0	--
		should have skipped but didn't	72	7.4	--	61	5.6	--	138	6.2	--
		missing	1	0.1	0.3	1	0.1	0.2	3	0.1	0.3
			979	100.0	100.0	1088	100.0	100.1[e]	2235	100.1[e]	100.0
27-G	During the past 3 months, how much pain has your weight caused you?	1 - a great deal	0	0.0	0.0	15	1.4	2.4	16	0.7	1.6
		2 - some pain	7	0.7	2.2	43	4.0	6.9	51	2.3	5.0
		3 - a little pain	22	2.2	6.9	61	5.6	9.8	89	4.0	8.7
		4 - no pain at all	292	29.8	91.0	503	46.2	80.5	866	38.7	84.5
		skipped item	587	60.0	--	403	37.0	--	1074	48.0	--
		should have skipped but didn't	71	7.2	--	60	5.5	--	136	6.1	--
		missing	0	0.0	0.0	3	0.3	0.5	3	0.1	0.3
			979	99.9[e]	100.1[e]	1088	100.0	100.1[e]	2235	99.9[e]	100.1[e]

Table D.2—continued

Item[a]	Item Content	Response	Men (N=979)			Women (N=1088)			Total (N=2235)[b]		
			Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-h	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	3	0.3	0.5	3	0.1	0.3
		2 - most of the time	2	0.2	0.6	12	1.1	1.9	14	0.6	1.4
		3 - some of the time	7	0.7	2.2	46	4.2	7.4	54	2.4	5.3
		4 - a little of the time	16	1.6	5.0	76	7.0	12.2	99	4.4	9.6
		5 - none of the time	296	30.2	92.2	485	44.6	77.6	852	38.1	83.1
		skipped item	586	60.0	--	[illegible]02	36.9	--	1073	48.0	--
		should have skipped but didn't	71	7.2	--	61	5.6	--	137	6.1	--
		missing	0	0.0	0.0	3	0.3	0.5	3	0.1	0.3
			979	99.9[e]	100.0	1088	100.0	100.1[e]	2235	99.8[e]	100.0

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[a] Item number from Enrollment Medical History Questionnaire, Form A.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who should have responded to item (including persons with missing values on item 27).

[d] If no, all remaining items skipped.

[e] Does not equal 100.0 due to rounding error.

Table D.3

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: FITCHBURG ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

			Men (N=216)			Women (N=249)			Total (N=483)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
1	How tall are you without shoes on?	responded	214	99.1	--	244	98.0	--	476	98.6	--
		missing	2	0.9		5	2.0		7	1.4	
	____ feet		216	100.0		249	100.0		483	100.0	
	____ inches	responded	214	99.1	--	243	97.6	--	475	98.3	--
		missing	2	0.9		6	2.4		8	1.7	
			216	100.0		249	100.0		483	100.0	
2	How much do you weigh without heavy clothes?	responded	215	99.5	--	242	97.2	--	475	98.3	--
		missing	1	0.5		7	2.8		8	1.7	
	____ pounds		216	100.0		249	100.0		483	100.0	
26	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.]	responded	213	98.6	--	244	98.0	--	475	98.3	--
		missing	3	1.4		5	2.0		8	1.7	
			216	100.0		249	100.0		483	100.0	
27	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	67	31.0		137	55.0		211	43.7	
		2 - no[d]	148	68.5	--	111	44.6	--	270	55.9	--
		missing	1	0.5		1	0.4		2	0.4	
			216	100.0		249	100.0		483	100.0	
27-A	Are you currently on a diet to lose weight?	1 - yes	11	5.1	16.2	56	22.5	40.6	71	14.7	33.3
		2 - no	56	25.9	82.4	80	32.1	58.0	139	28.8	65.3
		skipped item	129	59.7	--	98	39.4	--	237	49.1	--
		should have skipped but didn't	19	8.8	--	13	5.2	--	33	6.8	--
		missing	1	0.5	1.5	2	0.8	1.4	3	0.6	1.4
			216	100.0	100.1[e]	249	100.0	100.0	483	100.0	100.0
27-B	Are you doing any special exercises to lose weight?	1 - yes	14	6.5	20.6	45	18.1	32.6	61	12.6	28.6
		2 - no	53	24.5	77.9	93	37.3	67.4	151	31.3	70.9
		skipped item	130	60.2	--	100	40.2	--	240	49.7	--
		should have skipped but didn't	18	8.3	--	11	4.4	--	30	6.2	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.0	249	100.0	100.0	483	100.0	100.0

Table D.3—continued

			Men (N=216)			Women (N=249)			Total (N=483)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-C	Are you taking any reducing pills which have been prescribed by a doctor	1 - yes	2	0.9	2.9	5	2.0	3.6	7	1.4	3.3
		2 - no	65	30.1	95.6	133	53.4	96.4	205	42.4	96.2
		skipped item	133	61.6	--	99	39.8	--	241	49.9	--
		should have skipped but didn't	15	6.9	--	12	4.8	--	29	6.0	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.0	249	100.0	100.0	483	99.9[e]	100.0
27-D	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	2	0.9	2.9	14	5.6	10.1	16	3.3	7.5
		2 - no	65	30.1	95.6	124	49.8	89.9	196	40.6	92.0
		skipped item	133	61.6	--	100	40.2	--	243	50.3	--
		should have skipped but didn't	15	6.9	--	11	4.4	--	27	5.6	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.0	249	100.0	100.0	483	100.0	100.0
27-E	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	5	2.3	7.4	11	4.4	8.0	16	3.3	7.5
		2 - no	62	28.7	91.2	127	51.0	92.0	196	40.6	92.0
		skipped item	134	62.0	--	101	40.6	--	245	50.7	--
		should have skipped but didn't	14	6.6	--	10	4.0	--	25	5.2	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.1[e]	249	100.0	100.0	483	100.0	100.0
27-F	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	1	0.5	1.5	30	12.0	21.7	32	6.6	15.0
		2 - somewhat	10	4.6	14.7	40	16.1	29.0	51	10.6	23.9
		3 - a little	37	17.1	54.4	51	20.5	37.0	89	18.4	41.8
		4 - not at all	19	8.8	27.9	17	6.8	12.3	40	8.3	18.8
		skipped item	131	60.6	--	100	40.2	--	241	49.9	--
		should have skipped but didn't	17	7.9	--	11	4.4	--	29	6.0	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.1[e]	249	100.0	100.0	483	100.0	100.0
27-G	During the past 3 months, how much pain has your weight caused you?	1 - a great deal	0	0.0	0.0	1	0.4	0.7	1	0.2	0.5
		2 - some pain	0	0.0	0.0	10	4.0	7.2	10	2.1	4.7
		3 - a little pain	7	3.2	10.3	19	7.6	13.8	26	5.4	12.2
		4 - no pain at all	59	27.3	86.8	108	43.4	73.3	174	36.0	81.7
		skipped item	131	60.6	--	100	40.2	--	241	49.9	--
		should have skipped but didn't	17	7.9	--	11	4.4	--	29	6.0	--
		missing	2	0.9	2.9	0	0.0	0.0	2	0.4	0.9
			216	99.9[e]	100.0	249	100.0	100.0	483	100.0	100.0

Item[a]	Item Content	Response	Men (N=216)			Women (N=249)			Total (N=483)[b]		
			Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-H	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
		2 - most of the time	0	0.0	0.0	3	1.2	2.2	3	0.6	1.4
		3 - some of the time	2	0.9	2.9	11	4.4	8.0	13	2.7	6.1
		4 - a little of the time	3	1.4	4.4	20	8.0	14.5	24	5.0	11.3
		5 - none of the time	62	28.7	91.2	104	41.8	75.4	172	35.6	80.8
		skipped item	132	61.1	--	100	40.2	--	241	49.9	--
		should have skipped but didn't	16	7.4	--	11	4.4	--	29	6.0	--
		missing	1	0.5	1.5	0	0.0	0.0	1	0.2	0.5
			216	100.0	100.0	249	100.0	100.1[e]	483	100.0	100.1[e]

[a] Item number from Enrollment Medical History Questionnaire, Form A.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who should have responded to item (including persons with missing values on item 27).

[d] If no, all remaining items skipped.

[e] Does not equal 100.0 due to rounding error.

Table D.4

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: FRANKLIN COUNTY ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

			Men (N=265)			Women (N=306)			Total (N=585)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
1	How tall are you without shoes on?	responded	262	98.9	--	301	98.4	--	577	98.6	--
		missing	3	1.1		5	1.6		8	1.4	
	____ feet		265	100.0		306	100.0		585	100.0	
	____ inches	responded	262	98.9	--	300	98.0	--	576	98.5	--
		missing	3	1.1		6	2.0		9	1.5	
			265	100.0		306	100.0		585	100.0	
2	How much do you weigh without heavy clothes?	responded	260	98.1	--	299	97.7	--	573	97.9	--
		missing	5	1.9		7	2.3		12	2.0	
	_____ pounds		265	100.0		306	100.0		585	99.9[d]	
26	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.]	responded	265	100.0	--	301	98.4	--	580	99.1	--
		missing	0	0.0		5	1.6		5	0.8	
			265	100.0		306	100.0		585	99.9[d]	
	_____ pounds										
27	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	84	31.7	--	170	55.6	--	261	44.6	--
		2 - no[e]	180	67.9		136	44.4		323	55.2	
		missing	1	0.4		0	0.0		1	0.2	
			265	100.0		306	100.0		585	100.0	
27-A	Are you currently on a diet to lose weight?	1 - yes	17	6.4	20.0	61	19.9	35.9	78	13.3	29.8
		2 - no	66	24.9	77.6	107	35.0	62.9	180	30.8	68.7
		skipped item	153	57.7	--	117	38.2	--	277	47.4	--
		should have skipped but didn't	27	10.2	--	19	6.2	--	46	7.9	--
		missing	2	0.8	2.4	2	0.6	1.2	4	0.7	1.5
			265	100.0	100.0	306	99.9[d]	100.0	585	100.1[d]	100.0
27-B	Are you doing any special exercises to lose weight?	1 - yes	18	6.8	21.2	41	13.4	24.1	60	10.2	22.9
		2 - no	66	24.9	77.6	128	41.8	75.3	200	34.2	76.3
		skipped item	154	58.1	--	118	38.6	--	279	47.7	--
		should have skipped but didn't	28	10.6	--	18	5.9	--	44	7.5	--
		missing	1	0.4	1.2	1	0.3	0.6	2	0.3	0.8
			265	99.8[d]	100.0	306	100.0	100.0	585	99.9[d]	100.0

			Men (N=265)			Women (N=306)			Total (N=585)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-C	Are you taking any reducing pills which have been prescribed by a doctor?	1 - yes	1	0.4	1.2	5	1.6	2.9	6	1.0	2.3
		2 - no	83	31.3	97.6	165	53.9	97.1	255	43.6	97.3
		skipped item	152	57.4	--	118	38.6	--	277	47.4	--
		should have skipped but didn't	28	10.6	--	18	5.9	--	46	7.9	--
		missing	1	0.4	1.2	0	0.0	0.0	1	0.2	0.4
			265	100.1[d]	100.0	306	100.0	100.0	585	100.1[d]	100.0
27-D	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	1	0.4	1.2	17	5.6	10.0	18	3.1	6.9
		2 - no	83	31.3	97.6	151	49.3	88.8	241	4.1	92.0
		3 - skipped item	152	57.4	--	118	38.6	--	279	47.7	--
		should have skipped but didn't	28	10.6	--	18	5.9	--	44	7.5	--
		missing	1	0.4	1.2	2	0.6	1.2	3	0.5	1.1
			265	100.1[d]	100.0	306	100.0	100.0	585	99.9[d]	100.0
27-E	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	3	1.1	3.5	7	2.3	4.1	10	1.7	3.8
		2 - no	81	30.6	95.3	162	52.9	95.3	250	42.7	95.4
		skipped item	155	58,5	--	118	38.6	--	280	47.9	--
		should have skipped but didn't	25	9.4	--	18	5.9	--	43	7.4	--
		missing	1	0.4	1.2	1	0.3	0.6	2	0.3	0.8
			265	100.0	100.0	306	100.0	100.0	585	100.0	100.0
27-F	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	5	1.9	5.9	36	11.8	21.2	42	7.2	16.0
		2 - somewhat	18	6.8	21.2	43	14.0	25.3	61	10.4	23.3
		3 - a little	42	15.8	49.4	72	23.5	42.4	116	19.8	44.3
		4 - not at all	19	7.2	22.4	19	6.2	11.2	42	7.2	16.0
		skipped item	155	58.5	--	117	38.2	--	279	47.7	--
		should have skipped but didn't	25	9.4	--	19	6.2	--	44	7.5	--
		missing	1	0.4	1.2	0	0.0	0.0	1	0.2	0.4
			265	100.0	100.1[d]	306	99.9[d]	100.1[d]	585	100.0	100.0
27-G	During the past 3 months, how much pain has your weight caused you?	1 - a great deal	0	0.0	0.0	3	1.0	1.8	3	0.5	1.1
		2 - some pain	1	0.4	1.2	4	1.3	2.4	5	0.8	1.9
		3 - a little pain	11	4.1	12.9	13	4.2	7.6	24	4.1	9.2
		4 - no pain at all	72	27.2	84.7	150	49.0	88.2	229	39.1	87.4
		skipped item	155	58.5	--	117	38.2	--	279	47.7	--
		should have skipped but didn't	25	9.4	--	19	6.2	--	44	7.5	--
		missing	1	0.4	1.2	0	0.0	0.0	1	0.2	0.4
			265	100.0	100.0	306	99.9[d]	100.0	585	99.9[d]	100.0

Table D.4—continued

			Men (N=265)			Women (N=306)			Total (N=585)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-H	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
		2 - most of the time	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
		3 - some of the time	1	0.4	1.2	8	2.6	4.7	9	1.5	3.4
		4 - a little of the time	7	2.6	8.2	13	4.2	7.6	20	3.4	7.6
		5 - none of the time	76	28.7	89.4	149	48.7	87.6	232	36.6	88.5
		skipped item	155	58.5	--	117	38.2	--	279	47.7	--
		should have skipped but didn't	25	9.4	--	19	6.2	--	44	7.5	--
		missing	1	0.4	1.2	0	0.0	0.0	1	0.2	0.4
			265	100.0	100.0	306	99.9[d]	99.9[d]	585	99.9[d]	99.9[d]

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[a] Item number from Enrollment Medical History Questionnaire, Form A.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who should have responded to item (including persons with missing values on item 27).

[d] Does not equal 100.0 due to rounding error.

[e] If no, all remaining items skipped.

Table D.5

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: CHARLESTON ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

			Men (N=262)			Women (N=348)			Total (N=634)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
1	How tall are you without shoes on? ____ feet	responded	252	96.2	--	329	94.5	--	603	95.1	--
		missing	10	3.8		19	5.5		31	4.9	
			262	100.0		348	100.0		634	100.0	
	____ inches	responded	252	96.2	--	325	93.4	--	600	94.6	--
		missing	10	3.8		23	6.6		34	5.4	
			262	100.0		348	100.0		634	100.0	
2	How much do you weigh without heavy clothes? ____ pounds	responded	256	97.7	--	332	95.4	--	610	96.2	--
		missing	6	2.3		16	4.6		24	3.8	
			262	100.0		348	100.0		634	100.0	
26	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.]	responded	256	97.7	--	335	96.3	--	613	96.7	--
		missing	6	2.3		13	3.7		21	3.3	
			262	100.0		348	100.0		634	100.0	
27	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	61	23.3	--	148	42.5	--	217	34.2	--
		2 - no[d]	200	76.3		197	56.6		413	65.1	
		missing	1	0.4		3	0.9		4	0.6	
			262	100.0		348	100.0		634	99.9[e]	
27-A	Are you currently on a diet to lose weight?	1 - yes	11	4.2	17.7	58	16.7	38.4	70	11.0	31.7
		2 - no	50	19.1	80.6	89	25.6	58.9	146	23.0	66.1
		skipped item	176	67.2	--	164	47.1	--	355	56.0	--
		should have skipped but didn't	24	9.2	--	33	9.5	--	58	9.1	--
		missing	1	0.4	1.6	4	1.1	2.6	5	0.8	2.3
			262	100.1[e]	99.9[e]	348	100.0	99.9[e]	634	99.9[e]	100.1[e]
27-B	Are you doing any special exercises to lose weight?	1 - yes	11	4.2	17.7	44	12.6	29.1	57	9.0	25.8
		2 - no	50	19.1	80.6	104	29.9	68.9	160	25.2	72.4
		skipped item	177	67.5	--	164	47.1	--	357	56.3	--
		should have skipped but didn't	23	8.8	--	33	9.5	--	56	8.8	--
		missing	1	0.4	1.6	3	0.9	2.0	4	0.6	1.8
			262	100.0	99.9[e]	348	100.0	100.0	634	99.9[e]	100.0

Table D.5—continued

Item[a]	Item Content	Response	Men (N=262)			Women (N=348)			Total (N=634)[b]		
			Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-C	Are you taking any reducing pills which have been prescribed by a doctor?	1 - yes	3	1.1	4.8	8	2.3	5.3	11	1.7	5.0
		2 - no	58	22.1	93.5	139	39.9	92.1	205	32.3	92.8
		skipped item	177	67.5	--	156	44.8	--	349	55.0	--
		should have skipped but didn't	23	8.8	-	41	11.8	--	64	10.1	--
		missing	1	0.4	1.6	4	1.1	2.6	5	0.8	2.3
			262	99.9[e]	99.9[e]	348	99.9[e]	100.0	634	99.9[e]	100.1[e]
27-D	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	3	1.1	4.8	17	4.9	11.3	20	3.2	9.0
		2 - no	58	22.1	93.5	131	37.6	86.8	197	31.1	89.1
		skipped item	177	67.5	--	157	45.1	-	350	55.2	--
		should have skipped but didn't	23	8.8	--	40	11.5	--	63	9.9	--
		missing	1	0.4	1.6	3	0.9	2.0	4	0.6	1.8
			262	99.9[e]	99.9[e]	348	100.0	100.1[e]	634	100.1[e]	99.9[e]
27-E	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	4	1.5	6.5	16	4.6	10.6	20	3.2	9.0
		2 - no	57	21.8	91.9	131	37.6	86.8	196	30.9	88.7
		skipped item	178	67.9	--	157	45.1	-	351	55.4	--
		should have skipped but didn't	22	8.4	--	40	11.5	--	62	9.8	--
		missing	1	0.4	1.6	4	1.1	2.6	5	0.8	2.3
			262	100.0	100.0	348	99.9[e]	100.0	634	100.1[e]	100.0
27-F	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	2	0.8	3.2	42	12.1	27.8	47	7.4	21.3
		2 - somewhat	19	7.2	30.6	41	11.8	27.2	62	9.8	28.1
		3 - a little	34	13.0	54.8	53	15.2	35.1	90	14.2	40.7
		4 - not at all	6	2.3	9.7	12	3.4	7.9	18	2.8	8.1
		skipped item	169	64.5	--	148	42.5	--	333	52.5	--
		should have skipped but didn't	31	11.8	--	49	14.1	--	80	12.6	--
		missing	1	0.4	1.6	3	0.9	2.0	4	0.6	1.8
			262	100.0	99.9[e]	348	100.0	100.0	634	99.9[e]	100.0
27-G	During the past 3 months, how much pain has your weight caused you?	1 - a great deal	0	0.0	0.0	6	1.7	4.0	6	0.9	2.7
		2 - some pain	2	0.8	3.2	12	3.4	7.9	16	2.5	7.2
		3 - a little pain	12	4.6	19.4	24	6.9	15.9	37	5.8	16.7
		4 - no pain at all	47	17.9	75.8	104	29.9	68.9	156	24.6	70.6
		skipped item	169	64.5	--	148	42.5	--	333	52.5	--
		should have skipped but didn't	31	11.8	--	49	14.1	--	80	12.6	--
		missing	1	0.4	1.6	5	1.4	3.3	6	0.9	2.7
			262	100.0	100.0	348	99.9[e]	100.0	634	99.8[e]	99.9[e]

Item[a]	Item Content	Response	Men (N=262)			Women (N=348)			Total (N=634)[b]		
			Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-H	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	2	0.6	1.3	2	0.3	0.9
		2 - most of the time	1	0.4	1.6	6	1.7	4.0	7	1.1	3.3
		3 - some of the time	2	0.8	3.2	15	4.3	9.9	18	2.8	8.1
		4 - a little of the time	7	2.7	11.3	21	6.0	13.9	32	5.0	14.5
		5 - none of the time	51	19.5	82.3	104	29.9	68.9	158	24.9	71.5
		skipped item	169	64.5	--	148	42.5	--	333	52.5	--
		should have skipped but didn't	31	11.8	--	49	14.1	--	80	12.6	--
		missing	1	0.4	1.6	3	0.9	2.0	4	0.6	1.8
			262	100.1[e]	100.0	348	100.0	100.0	634	99.8[e]	100.0

[a] Item number from Enrollment Medical History Questionnaire, Form A.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who should have responded to item (including persons with missing values on item 27).

[d] If no, all remaining items skipped.

[e] Does not equal 100.0 due to rounding error.

Table D.6

FREQUENCY DISTRIBUTION OF RESPONSES TO WEIGHT ITEMS FOR PEOPLE AGED 14 TO 74: GEORGETOWN ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

			Men (N=293)			Women (N=346)			Total (N=666)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
1	How tall are you without shoes on? ____ feet	responded	281	95.9	--	325	93.9	--	630	94.6	--
		missing	12	4.1		21	6.1		36	5.4	
			293	100.0		346	100.0		666	100.0	
	____ inches	responded	280	95.6	--	323	93.4	--	627	94.1	--
		missing	13	4.4		23	6.6		39	5.9	
			293	100.0		346	100.0		666	100.0	
2	How much do you weigh without heavy clothes? _____ pounds	responded	284	96.9	--	328	94.8	--	630	94.6	--
		missing	9	3.1		18	5.2		30	5.4	
			293	100.0		346	100.0		666	100.0	
26	What is the most you have ever weighed? [Women: Do not count times when you were pregnant.]	responded	282	96.2	--	339	98.0	--	647	97.2	--
		missing	11	3.8		7	2.0		19	2.8	
			293	100.0		346	100.0		666	100.0	
27	Do you think you weigh too much now, or has a doctor or nurse told you that you now weigh too much?	1 - yes	54	18.4	--	140	40.5	--	196	29.4	--
		2 - no[d]	239	81.6		205	59.2		468	70.3	
		missing	0	0.0		1	0.3		2	0.3	
			293	100.0		346	100.0		666	100.0	
27-A	Are you currently on a diet to lose weight?	1 - yes	8	2.7	14.8	36	10.4	25.5	44	6.6	22.2
		2 - no	46	15.7	85.2	101	29.2	71.6	149	22.4	75.3
		skipped item	194	66.2	--	156	45.1	--	371	55.7	--
		should have skipped but didn't	45	15.4	--	49	14.2	--	97	14.6	--
		missing	0	0.0	0.0	4	1.2	2.8	5	0.8	2.5
			293	100.0	100.0	346	100.1[e]	99.9[e]	666	100.1[e]	100.0
27-B	Are you doing any special exercises to lose weight?	1 - yes	7	2.4	13.0	28	8.1	19.9	36	5.4	18.2
		2 - no	47	16.0	87.0	112	32.4	79.4	160	24.0	80.8
		skipped item	192	65.5	--	159	46.0	--	372	55.8	--
		should have skipped but didn't	47	16.0	--	46	13.3	--	96	14.4	--
		missing	0	0.0	0.0	1	0.3	0.7	2	0.3	1.0
			293	99.9[e]	100.0	346	100.1[e]	100.0	666	99.9[e]	100.0

			Men (N=293)			Women (N=346)			Total (N=666)[b]		
Item[a]	Item Content	Response	Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-C	Are you taking any reducing pills which have been prescribed by a doctor?	1 - yes	0	0.0	0.0	4	1.2	2.8	4	0.6	2.0
		2 - no	54	18.4	100.0	136	39.3	96.5	192	28.8	97.0
		skipped item	190	64.8	--	156	45.1	-	366	55.0	--
		should have skipped but didn't	49	16.7	--	49	14.2	--	102	15.3	--
		missing	0	0.0	0.0	1	0.3	0.7	2	0.3	1.0
			293	99.9[e]	100.0	346	100.1[e]	100.0	666	100.0	100.0
27-D	Are you going to Weight Watchers, or to a reducing salon or exercise gym or health spa to lose weight?	1 - yes	0	0.0	0.0	7	2.0	5.0	7	1.0	3.5
		2 - no	54	18.4	100.0	133	38.4	94.3	189	28.4	95.5
		skipped item	191	65.2	--	158	45.7	--	369	55.4	--
		should have skipped but didn't	48	16.4	--	47	13.6	--	99	14.9	--
		missing	0	0.0	0.0	1	0.3	0.7	2	0.3	1.0
			293	100.0	100.0	346	100.0	100.0	666	100.0	100.0
27-E	Are you currently under the care or supervision of a doctor to lose weight?	1 - yes	4	1.4	7.4	9	2.6	6.4	13	2.0	6.6
		2 - no	50	17.1	92.6	130	37.6	92.2	182	27.3	91.9
		skipped item	190	64.8	--	158	45.7	--	368	55.2	--
		should have skipped but didn't	49	16.7	--	47	13.6	--	100	15.0	--
		missing	0	0.0	0.0	2	0.6	1.4	3	0.4	1.5
			293	100.0	100.0	346	100.1[e]	100.0	666	99.9[e]	100.0
27-F	During the past 3 months, how much has your weight worried or concerned you?	1 - a great deal	5	1.7	9.3	37	10.7	26.2	42	6.3	21.2
		2 - somewhat	9	3.1	16.7	25	7.2	17.7	34	5.1	17.2
		3 - a little	20	6.8	37.0	58	16.8	41.1	78	11.7	39.4
		4 - not at all	19	6.5	35.2	20	5.8	14.2	41	6.2	20.7
		skipped item	188	64.2	--	155	44.8	--	362	54.3	--
		should have skipped but didn't	51	17.4	--	50	14.4	--	106	15.9	--
		missing	1	0.3	1.9	1	0.3	0.7	3	0.4	1.5
			293	100.0	100.1[e]	346	100.0	99.9[e]	666	99.9[e]	100.0
27-G	During the past 3 months, how much pain has your weight caused you?	1 - a great deal	0	0.0	0.0	5	1.4	3.5	5	0.8	2.5
		2 - some pain	2	0.7	3.7	10	2.9	7.1	12	1.8	6.1
		3 - a little pain	11	3.8	20.4	30	8.7	21.3	41	6.2	20.7
		4 - no pain at all	41	14.0	75.9	95	27.4	67.4	138	20.7	69.7
		skipped item	187	63.8	--	154	44.5	--	360	54.0	--
		should have skipped but didn't	52	17.7	--	51	14.7	--	108	16.2	--
		missing	0	0.0	0.0	1	0.3	0.7	2	0.3	1.0
			293	100.0	100.0	346	99.9[e]	100.0	666	100.0	100.0

Table D.6—continued

Item[a]	Item Content	Response	Men (N=293)			Women (N=346)			Total (N=666)[b]		
			Number	Percent of Men	Adjusted Percent[c]	Number	Percent of Women	Adjusted Percent[c]	Number	Percent of Total	Adjusted Percent[c]
27-H	During the past 3 months, how much of the time has your weight kept you from doing the kinds of things other people your age do?	1 - all of the time	0	0.0	0.0	1	0.3	0.7	1	0.2	0.5
		2 - most of the time	0	0.0	0.0	1	0.3	0.7	1	0.2	0.5
		3 - some of the time	2	0.7	3.7	12	3.5	8.5	14	2.1	7.1
		4 - a little of the time	6	2.0	11.1	23	6.6	16.3	29	4.4	14.6
		5 - none of the time	46	15.7	85.2	103	29.8	73.0	151	22.7	76.3
		skipped item	188	64.2	--	155	44.8	--	362	54.4	--
		should have skipped but didn't	51	17.4	--	50	14.4	--	104	15.6	--
		missing	0	0.0	0.0	1	0.3	0.7	2	0.3	1.0
			293	100.0	100.0	346	100.0	99.9[e]	666	99.9[e]	100.0

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[a] Item number from Enrollment Medical History Questionnaire, Form A.

[b] Number of men and women does not equal total because of missing values on sex.

[c] Percent of persons who should have responded to item (including persons with missing values on item 27).

[d] If no, all remaining items skipped.

[e] Does not equal 100.0 due to rounding error.

Table D.7

SUMMARY STATISTICS FOR WEIGHT, HEIGHT, AND MAXIMUM WEIGHT FOR PEOPLE AGED 14 AND OLDER: ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

		Weight in Pounds		Height in Inches		Maximum Weight	
Site/Sample	N	Mean	S.D.	Mean	S.D.	Mean	S.D.
Dayton							
Men	569	169.0	31.6	69.8	2.8	180.0	36.0
Women	632	135.7	28.0	64.1	2.6	145.9	31.8
Total	1212	151.5	34.1	66.8	3.9	162.1	37.9
Seattle							
Men	979	168.1	28.1	70.0	2.8	179.7	33.2
Women	1088	136.9	29.3	64.7	2.6	149.7	34.1
Total	2235	151.8	32.6	67.2	3.8	164.0	36.8
Fitchburg							
Men	216	171.1	32.6	69.3	2.8	182.8	38.4
Women	249	139.5	34.2	63.4	2.5	150.9	38.4
Total	483	154.7	36.8	66.2	3.9	165.8	41.4
Franklin County							
Men	265	168.8	31.6	69.5	3.2	182.9	37.5
Women	306	138.6	30.3	64.2	2.5	150.5	32.2
Total	585	152.6	34.2	66.6	3.9	165.6	38.1
Charleston							
Men	262	165.5	32.4	69.3	2.9	176.4	37.0
Women	348	139.3	34.0	63.9	2.9	149.1	39.6
Total	634	151.0	35.7	66.3	3.9	161.5	41.2
Georgetown County							
Men	293	169.1	35.2	69.[illegible]	3.3	178.8	39.2
Women	346	142.9	34.0	64.1	3.1	150.7	36.5
Total	666	154.6	36.6	66.4	4.1	163.0	39.9
All Sites Combined							
Men	2584	168.5	30.9	69.7	2.9	179.9	35.8
Women	2969	138.0	30.7	64.2	2.7	149.1	34.8
Total	5815	152.3	34.3	66.8	3.9	163.5	38.4

Table D.8

SUMMARY STATISTICS FOR WEIGHT AND HEIGHT OBTAINED FOR PEOPLE AGED 14 AND OLDER: ENROLLMENT MEDICAL SCREENING EXAMINATION

	Weight in Pounds																	
	First			Second			Average[a]			Repeat First			Repeat Second			Repeat Average[a]		
Site/Sample	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
Dayton																		
Men	289	167.2	30.5	289	167.0	30.4	288	167.0	30.5	10	175.8	19.6	10	175.7	19.6	10	175.9	19.7
Women	330	137.0	28.1	330	137.1	28.2	330	136.9	28.2	8	136.[illegible]	9.6	8	136.9	9.5	8	137.0	9.6
Total	626	151.0	32.8	626	150.9	32.7	625	150.8	32.8	18	158.5	25.3	18	158.5	25.2	18	158.6	25.3
Seattle																		
Men	485	170.3	28.4	485	170.2	28.5	485	170.3	28.4	11	167.4	31.9	10	163.2	28.2	9	162.9	30.0
Women	558	141.5	30.9	558	141.5	30.9	557	141.6	30.9	9	133.2	18.6	9	133.0	18.1	9	133.4	18.3
Total	1043	154.9	33.0	1043	154.9	33.0	1042	155.0	33.0	20	152.0	31.4	19	148.9	28.0	18	148.2	28.4
Fitchburg																		
Men	174	171.1	29.6	174	171.1	29.6	174	171.1	29.6	3	168.1	18.1	3	168.2	17.8	3	168.0	18.0
Women	184	143.7	36.2	184	143.6	36.3	184	143.7	36.2	3	134.2	24.8	3	134.4	24.9	3	134.7	24.9
Total	358	157.0	35.8	358	157.0	35.9	358	157.0	35.9	6	151.2	26.3	6	151.3	26.8	6	151.3	26.7
Franklin County																		
Men	206	172.0	33.7	206	172.0	33.7	205	172.2	33.7	5	159.2	28.9	5	159.2	29.0	5	159.2	29.1
Women	246	143.8	35.6	245	143.6	33.5	245	143.7	33.5	5	167.7	35.6	5	167.8	35.7	5	168.2	35.6
Total	452	156.6	36.4	451	156.6	36.4	450	156.7	36.5	10	163.5	30.9	10	163.5	31.0	10	163.7	31.0
Charleston																		
Men	186	165.2	33.9	185	165.1	34.0	185	165.[illegible]	34.0	5	164.[illegible]	24.8	5	164.8	24.9	5	164.8	24.6
Women	238	143.2	37.6	237	143.0	37.6	236	143.[illegible]	37.7	5	134.4	30.2	5	134.3	30.3	5	134.4	30.2
Total	424	152.8	37.6	422	152.7	37.7	421	[illegible]	37.7	10	149.5	30.6	10	149.6	30.7	10	149.6	30.5
Georgetown County																		
Men	203	171.3	35.3	203	171.3	35.3	203	171.3	35.3	6	161.6	40.5	6	161.4	40.5	6	161.5	40.7
Women	264	147.5	36.6	264	147.[illegible]	36.6	264	147.6	36.6	4	202.0	94.1	4	202.1	94.2	4	202.0	94.4
Total	467	157.9	37.9	467	157.[illegible]	37.9	467	157.9	37.9	10	177.8	65.6	10	177.7	65.6	10	177.7	65.8
All Sites Combined																		
Men	1543	169.5	31.4	1542	169.5	31.4	1540	169.6	31.4	40	167.3	27.5	39	166.2	26.5	38	166.3	26.9
Women	1820	142.3	33.3	1818	142.3	33.3	1816	142.3	33.3	34	147.5	41.9	34	147.5	41.9	34	147.7	41.9
Total	3370	154.8	35.1	3367	154.7	35.1	3363	154.8	35.1	74	158.2	36.0	73	157.5	35.6	72	157.5	35.8

	Height in Inches																	
	First			Second			Average[a]			Repeat First			Repeat Second			Repeat Average[a]		
Site/Sample	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Dayton																		
Men	289	68.9	2.6	289	69.0	2.6	289	68.9	2.6	14	68.5	2.0	14	68.6	2.0	14	68.6	2.1
Women	330	63.7	2.4	330	63.7	2.4	329	63.6	2.4	8	65.7	3.9	8	65.8	4.0	8	66.0	3.8
Total	626	66.1	3.6	626	66.1	3.6	625	66.0	3.6	22	67.5	3.1	22	67.5	3.1	22	67.7	3.0
Seattle																		
Men	485	69.0	2.6	485	69.0	2.6	485	69.1	2.6	11	67.8	1.9	11	68.0	2.0	11	68.0	2.1
Women	558	64.3	2.6	558	64.3	2.5	557	64.4	2.6	10	63.8	2.0	10	63.8	1.9	10	64.0	2.0
Total	1043	66.5	3.5	1043	66.5	3.5	1042	66.6	3.5	21	65.9	2.8	21	66.0	2.9	21	66.1	2.9
Fitchburg																		
Men	174	68.2	2.3	174	68.2	2.3	174	68.3	2.3	3	68.6	2.2	3	68.8	2.2	3	68.7	2.3
Women	184	62.8	2.4	184	62.7	2.4	184	62.8	2.4	3	63.4	1.8	3	63.4	1.8	3	63.7	2.1
Total	358	65.4	3.6	358	65.4	3.6	358	65.5	3.6	6	66.0	3.4	6	66.1	3.4	6	66.2	3.4
Franklin County																		
Men	206	68.8	3.0	206	68.8	3.0	206	68.9	3.0	5	67.6	1.6	5	67.6	1.3	5	67.8	1.6
Women	246	63.7	2.4	245	63.8	2.4	245	63.8	2.4	5	63.0	2.0	5	63.0	2.0	5	63.0	2.0
Total	452	66.0	3.7	451	66.1	3.7	451	66.1	3.7	10	65.3	2.9	10	65.3	2.9	10	65.4	3.1
Charleston																		
Men	186	68.4	2.8	186	68.4	2.9	186	68.4	2.9	5	69.0	1.2	5	69.0	1.2	5	68.8	1.3
Women	238	63.3	2.6	238	63.3	2.6	238	63.4	2.6	5	62.4	0.5	5	62.5	0.5	5	62.4	0.5
Total	424	65.6	3.7	424	65.5	3.7	424	65.6	3.7	10	65.7	3.5	10	65.7	3.5	10	65.6	3.5
Georgetown County																		
Men	203	68.0	2.7	203	68.0	2.7	203	68.1	2.8	6	66.2	2.1	6	66.3	2.1	6	66.2	2.0
Women	264	63.1	2.4	264	63.1	2.4	264	63.2	2.5	4	64.7	3.2	4	64.6	3.1	4	64.5	3.0
Total	467	65.2	3.5	467	65.2	3.6	467	65.3	3.6	10	65.6	2.6	10	65.6	2.5	10	65.5	2.5
All Sites Combined																		
Men	1543	68.7	2.7	1543	68.7	2.7	1543	68.7	2.7	44	68.0	2.0	44	68.1	2.0	44	68.1	2.0
Women	1820	63.7	2.5	1819	63.6	2.5	1817	63.7	2.6	35	64.0	2.7	35	64.0	2.7	35	64.1	2.7
Total	3370	66.0	3.6	3369	66.0	3.6	3367	66.0	3.6	79	66.2	3.0	79	66.3	3.0	79	66.3	3.0

[a] If the absolute difference between the first and second measure was greater than 3 percent of the average, the average measure was coded as missing.

Appendix E

DECILES OF SELECTED MEASURES

Table E.1

DECILES OF W/H^2 FOR MEN AND $W/H^{1.5}$ FOR WOMEN
(Enrollment Medical History Questionnaire and
Enrollment Medical Screening Examination)

	W/H^2 for Men		$W/H^{1.5}$ for Women	
Percent	MHQ (N=2500)	MSE (N=1540)	MHQ (N=2821)	MSE (N=1814)
10	19.81	20.23	23.99	25.51
20	21.18	21.67	25.17	25.94
30	22.24	22.78	26.17	27.17
40	23.09	23.78	27.17	28.42
50	24.11	24.86	28.44	29.54
60	25.04	25.83	29.63	30.99
70	25.83	27.02	31.26	32.91
80	27.13	28.41	33.71	36.11
90	28.89	30.38	38.09	40.69
100	47.93	49.44	80.44	69.55

Table E.2

DECILES OF W/H^p
(Enrollment Medical History Questionnaire and
Enrollment Medical Screening Examination)

	Men		Women		Total Sample	
Percent	MHQ[a] (N=2500)	MSE[b] (N=1540)	MHQ (N=2821)	MSE (N=1814)	MHQ (N=5321)	MSE (N=3354)
10	-1.20	-1.20	-.94	-.98	-1.06	-1.06
20	-.84	-.85	-.76	-.77	-.78	-.79
30	-.56	-.58	-.60	-.59	-.59	-.59
40	-.34	-.34	-.44	-.42	-.39	-.39
50	-.07	-.08	-.25	-.26	-.19	-.19
60	.17	.16	-.06	-.05	.01	.06
70	.38	.45	.20	.22	.29	.34
80	.72	.79	.58	.68	.65	.74
90	1.18	1.27	1.27	1.33	1.22	1.28
100	6.19	5.91	7.90	5.43	7.90	5.91

[a] Self-reported weight and height.

[b] Actual weight and height.

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